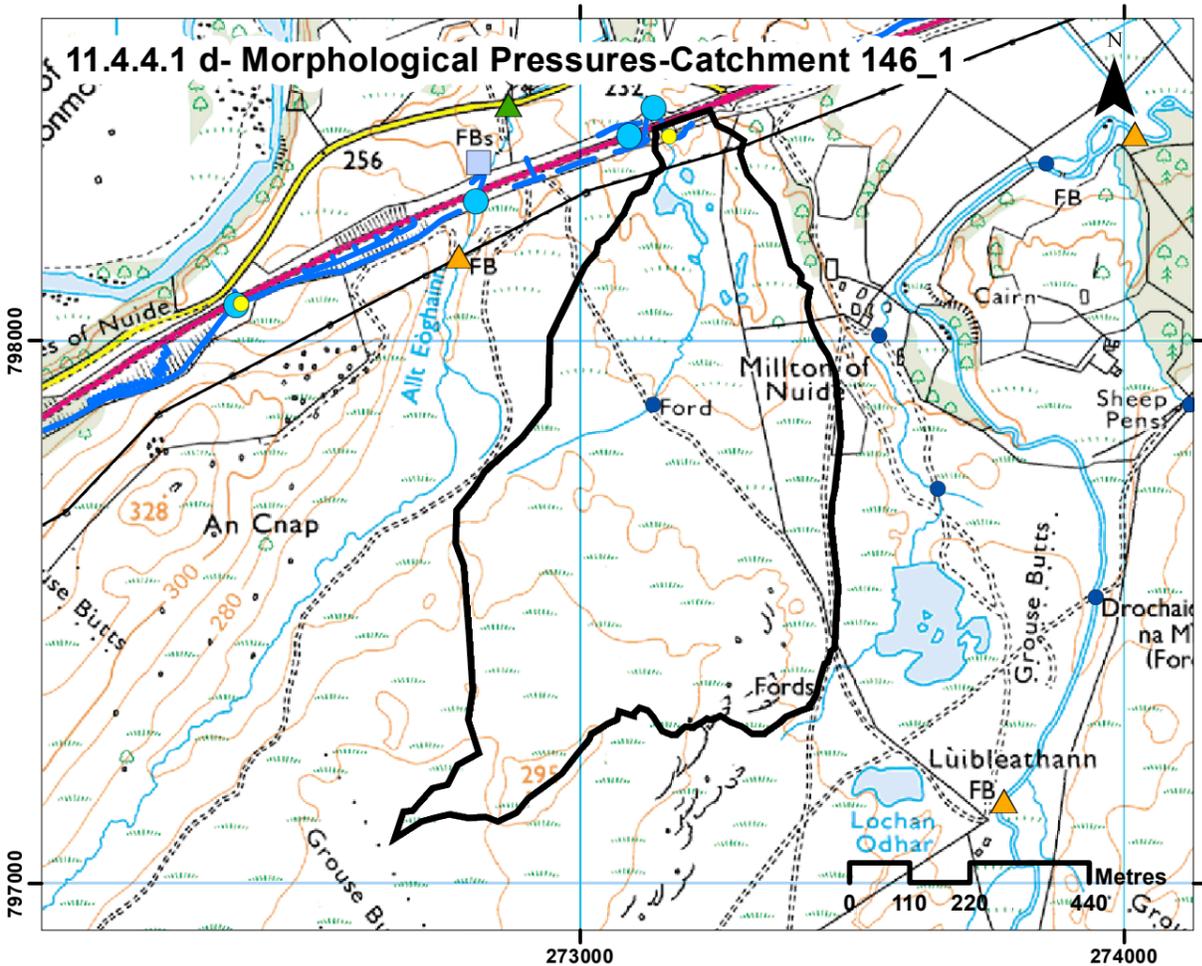
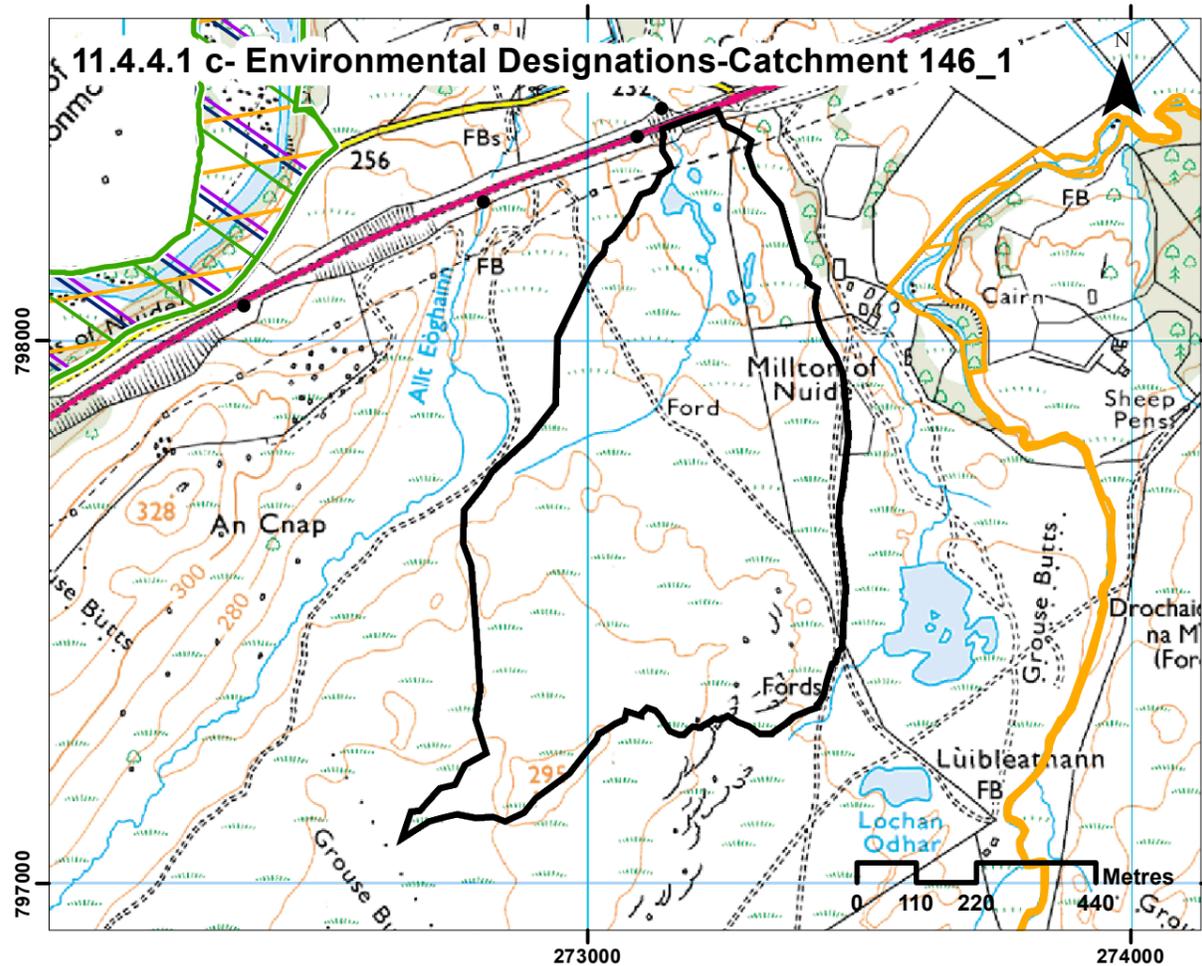
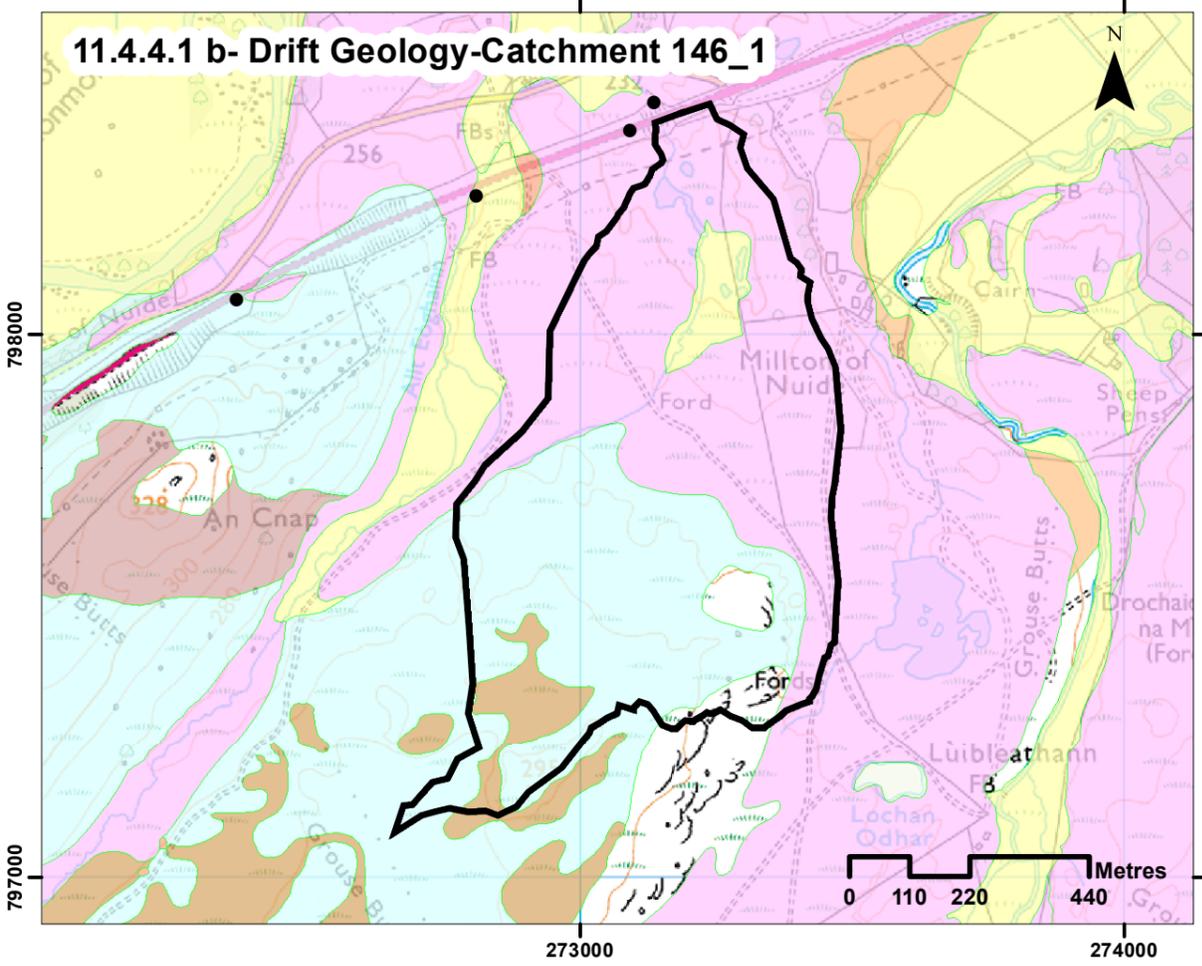
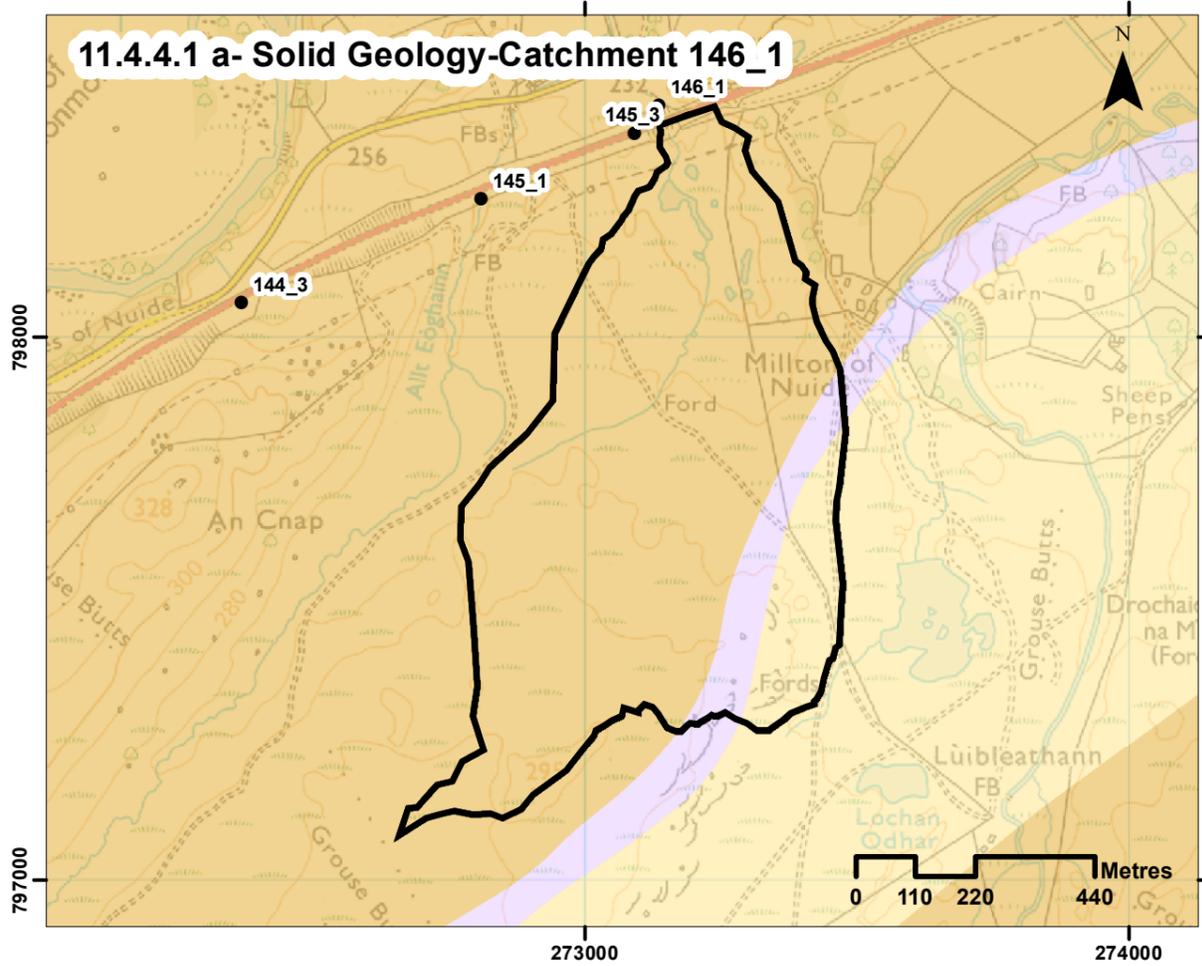


Appendix 11.4

Hydromorphology
Assessment Part 3

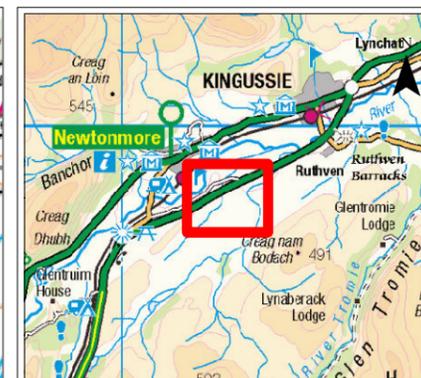
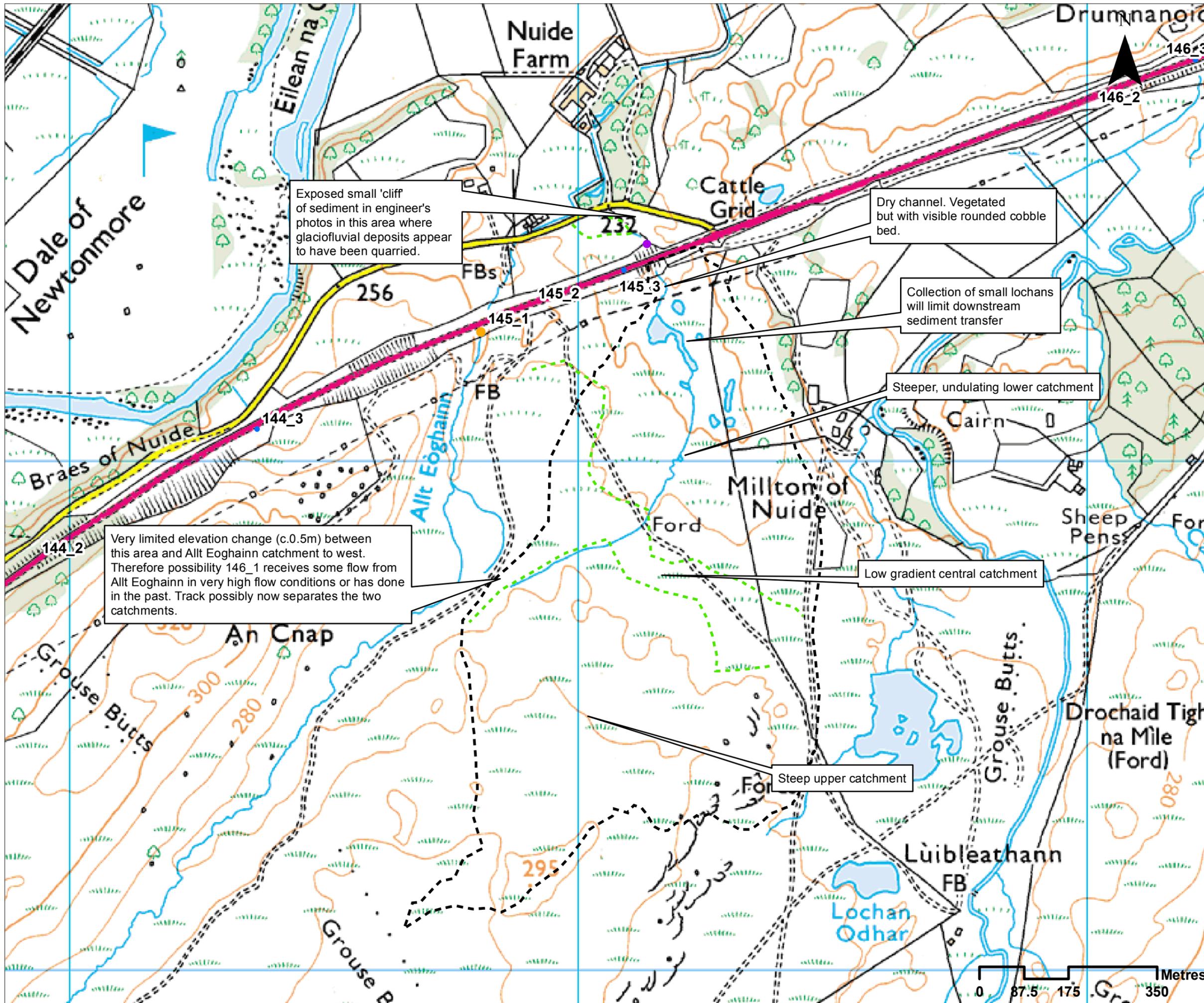
Annex 11.4.4-Hydromorphological Catchment Assessment-146_1

Catchment No.	146_1		
Catchment Name			
Channel Nature	Nature of water course Size of water course	Natural Minor	
Quantitative Spatial Elements	Catchment Area (km ²) Average slope in catchment (°) % Catchment over 750m (For snow melt risk)	0.6 3 0	
WFD classification	Water, flows and levels Physical condition Overall ecological status	Good Good Good	
Geology	Majority Bedrock (see Drawing 11.4.4.1 a and b Catchment 146_1) Is an alluvial fan present at or near the crossing?	Loch Laggan Psammite formation- Psammite, Micaceous No	resistant to weathering, impermeable
Environmental designations (see Drawing 11.4.4.1 c, Catchment 146_1)	Ramsar	Yes	River Spey - Insh Marshes Breeding birds, wetlands, freshwater habitats, trophic range river/stream, Whooper Swan
	SAC	Yes	Insh Marshes Alder woodland on floodplains, clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels, Otter, very wet mires often identified by an unstable quaking surface River Spey Atlantic salmon, freshwater pearl mussel, otter, sea lamprey
	SPA	Yes	River Spey - Insh Marshes Hen Harrier, Osprey breeding, Spotted Crane breeding, Whooper swan, Wigeon breeding, Wood Sandpiper
	SSSI	Yes	River Spey - Insh Marshes Arctic charr, breeding bird assemblage, flood plain fen, invertebrate assemblage, mesotrophic loch, Osprey breeding, Otter, vascular plant assemblage, Whooper swan
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.4.2, Catchment 146_1	
	Is peat present in the catchment?	Yes	Limited amount in upper catchment shown on BGS 1:50k, likely small area of blanket bog
	Is there a bog burst risk?	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	Engineer's photos indicate that channel is incised in some locations
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
Wooded/forested areas in catchment	No		
Infrastructure type (see Drawing 11.4.4.1 d, Catchment 146_1)	Yes	Access tracks, one of which possibly severs former connection with Allt Eoghainn catchment.	
Comment on sediment source potential in catchment	Appears limited - no obvious major sediment sources		
Comment on sediment supply potential to crossing	Sediment supply to crossing from the upper catchment is unlikely, as lochans in lower catchment are likely to trap much of it. However, cobbles shown in the currently dry channel bed may be mobilised if conditions wet enough for lochans to rise significantly and provide flow into this channel.		
Morphology and Process- Reach upstream of crossing	Channel morphology	Plane Bed	Observed as dry and well vegetated during both the engineer's and geomorphologist's field survey.
	Predominant sediment size	Cobble	
	Unvegetated bars	No	
	Vertical incision	Medium	Engineer's photos indicate some incision
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 146_1)	Yes	Site compound shown in google earth imagery. Possibly for A9 widening in 2000s (2006-??) Access Tracks. Fence blocking dry channel. Two concrete pipes issue at this point, but no flow was visible at point of survey and these appear to be mostly blocked by deposited sediment which has now vegetated.
	Impact of infrastructure	No	
	Channel realignment	No	
Morphology and Process- At crossing	Channel morphology	Engineered	Engineers notes indicate catch pit present and photos possibly indicate corrugated culvert but unclear.
	Predominant sediment size	-	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	Some possible as culvert appears to have standing water.
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	-	Unclear. Standing water in culvert indicates culvert not operating correctly.
Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	-	Not visible from photos
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 146_1)	Yes	Minor road and settlement of Nuide.
	Impact of infrastructure	Yes	Maybe flood risk considerations with regards to settlement of Nuide.
Channel realignment	No	Channel not shown on 1899 map.	
Summary behaviour	Limited activity in this catchment. Limited realignment u/s of crossing. Seems stable and vegetated. D/s of crossing realigned, probably during railway construction to take flow from this and other channels through just one point along the railway embankment.		



- #### Legend
- General**
- Crossing location
- Solid Geology**
- Gaik Psammite Formation - Psammite
 - Loch Laggan Psammite Formation - Psammite, Micaceous
 - North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite
 - Pitmain Semipelite Member - Semipelite And Calcsilicate-Rock
 - Pitmain Semipelite Member - Semipelite, Gneissose
 - Scottish Highland Ordovician Minor Intrusion Suite - Leucogranite
 - Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite- (Other Than Dykes) - Microdiorite
- Drift Geology**
- Peat
 - Glaciofluvial Ice Contact Deposits
 - Gaik Plateau Moraine Formation
 - Hummocky Glacial Deposits
 - Ardverkie Till Formation - Diamicton
 - Glaciofluvial Sheet Deposits
 - Alluvium
 - River Terrace Deposits
 - Alluvial Fan Deposits
 - Head
 - Talus - Rock Fragments
 - Talus Cone
- Environmental Designations**
- Ramsar
 - Special Site of Scientific Interest
 - Special Area of Conservation
 - Special Protection Area
- Morphological Pressures**
- Road Bridge
 - Track/Footbridge
 - Culvert
 - Catchpit
 - Ford
 - Abstraction Location
 - Drainage Ditch
 - Power Lines

REV	SUIT	DATE	DESCRIPTION	BY	APP
<p>ch2m FAIRHURST CH2MHILL Fairhurst JV C/O City Park 368 Alexandra Parade Glasgow G31 3AU Tel +44 (0) 141 552 2000 Fax +44 (0) 141 552 2525</p>					
<p>A9 TRANSPORT SCOTLAND PERTH TO INVERNESS CRUBENMORE TO KINRAIG</p>					
<p>9 CRUBENMORE TO KINRAIG EIA</p>					
<p>Drawing 11.4.4.1 Catchment 146_1 Catchment Overview</p>					
DESIGN: EL	DRAWN: EVW	CHK: EL	APP: EL		
DATE: 20/12/2017					
PROJ: 495298					
DWG: A9P09-CFJ-EWE-Z_77777_ZZ-DR-EN-0009					
SHEET: 1 of 1	REVISION: C01	SUITABILITY: A3			



- Legend**
- Major crossing
 - Minor crossing
 - Other crossing
 - - - Break in slope
 - Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

ch2m: FAIRHURST
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 C/O: City Park 368 Alexandra Parade Glasgow G31 3AU
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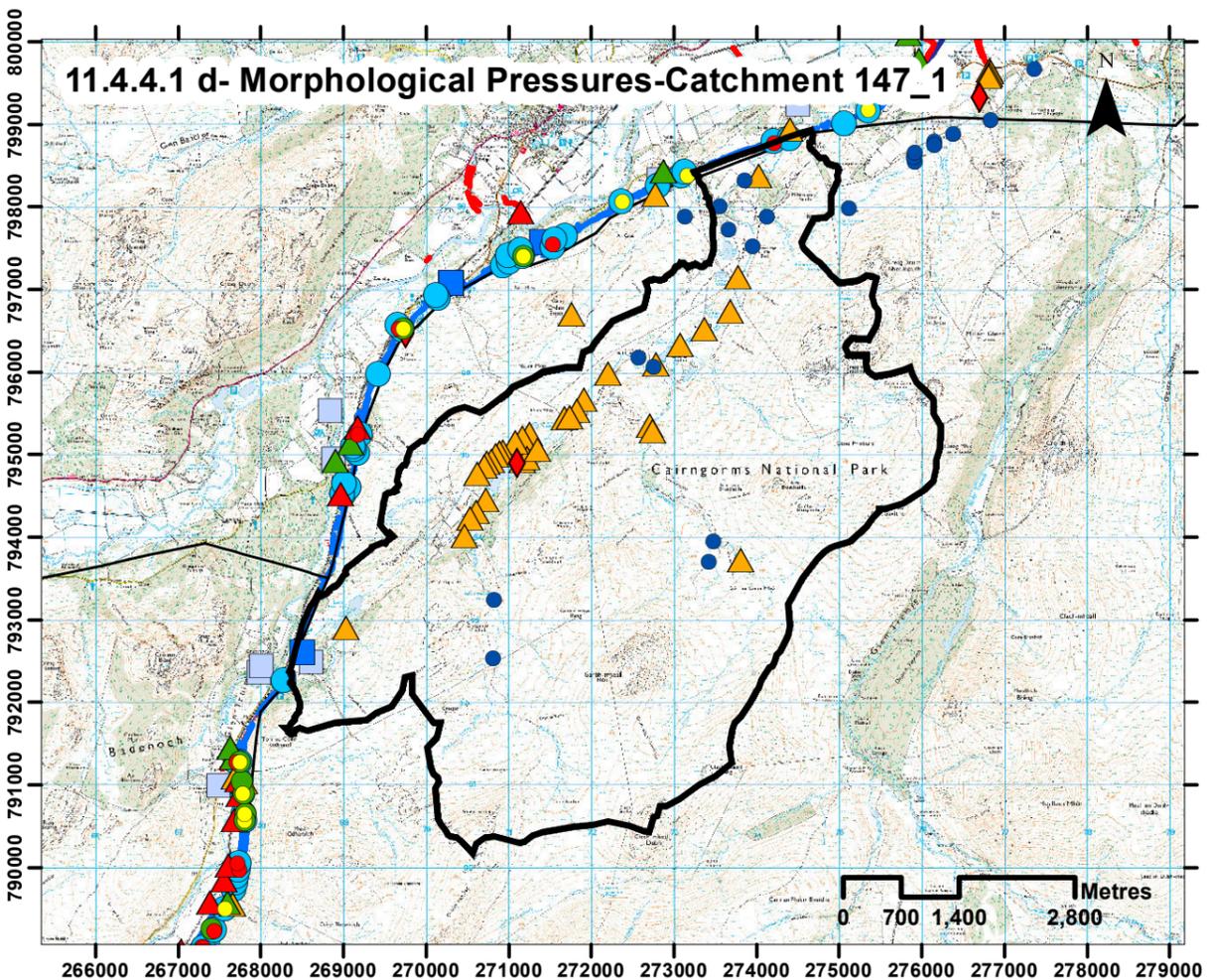
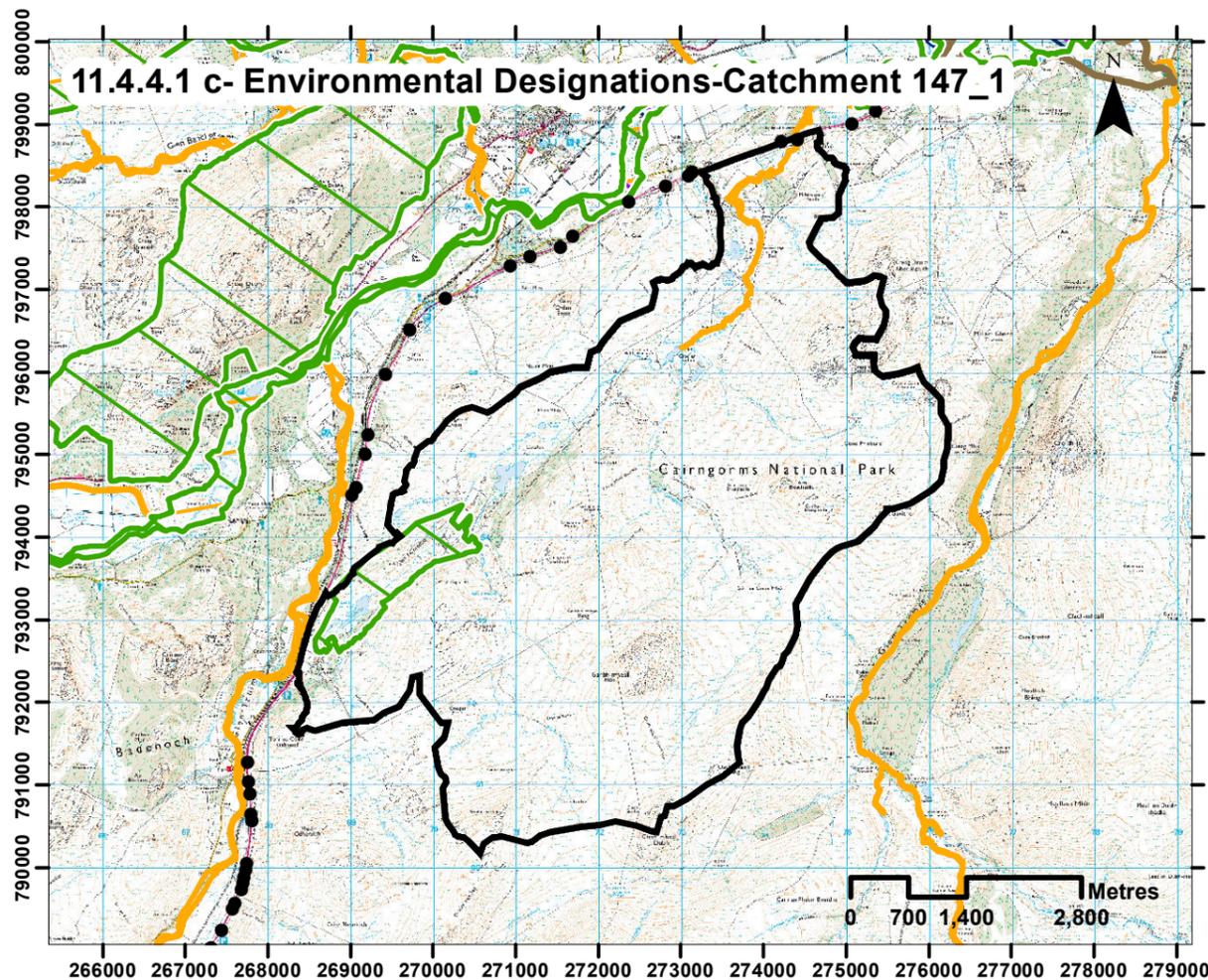
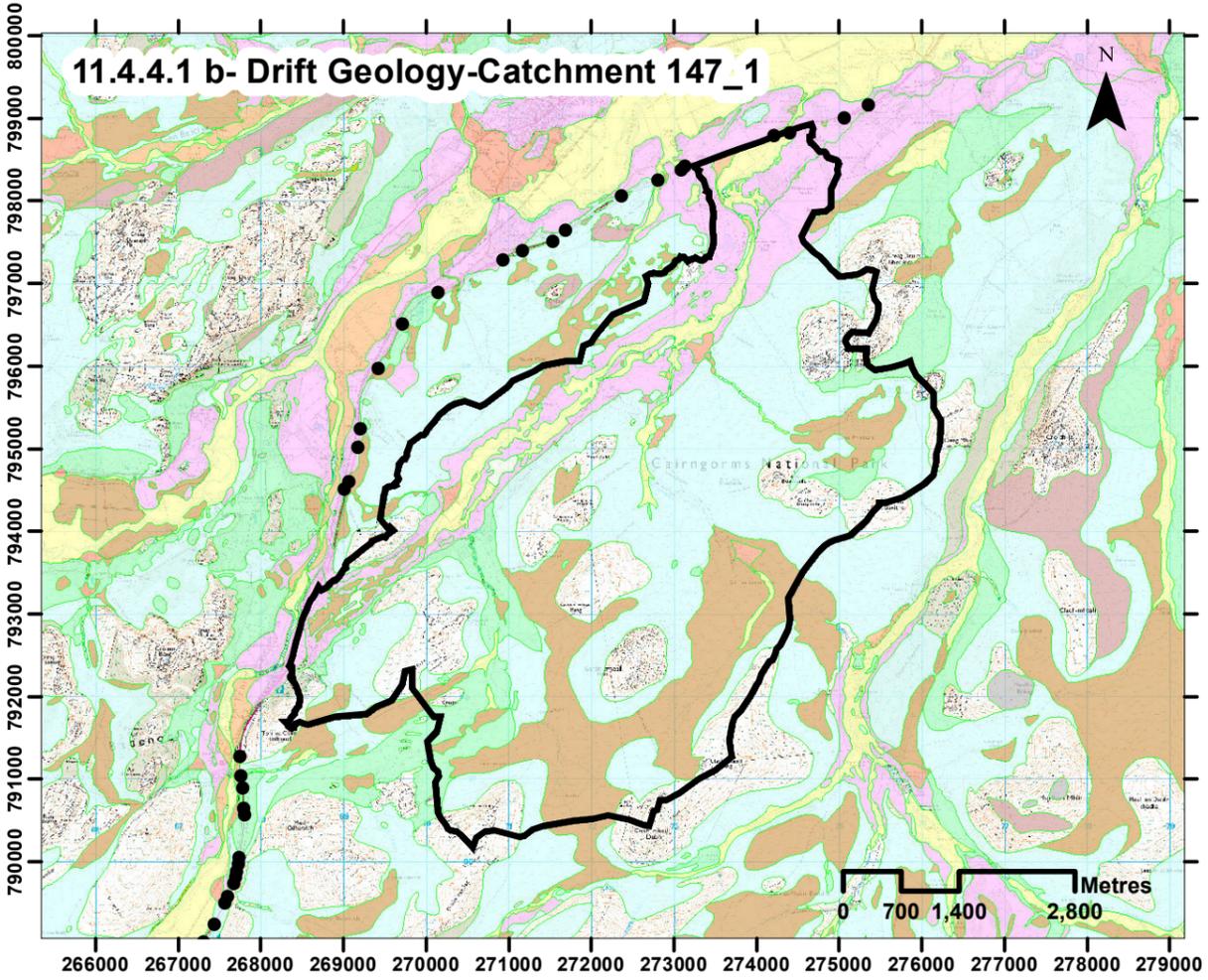
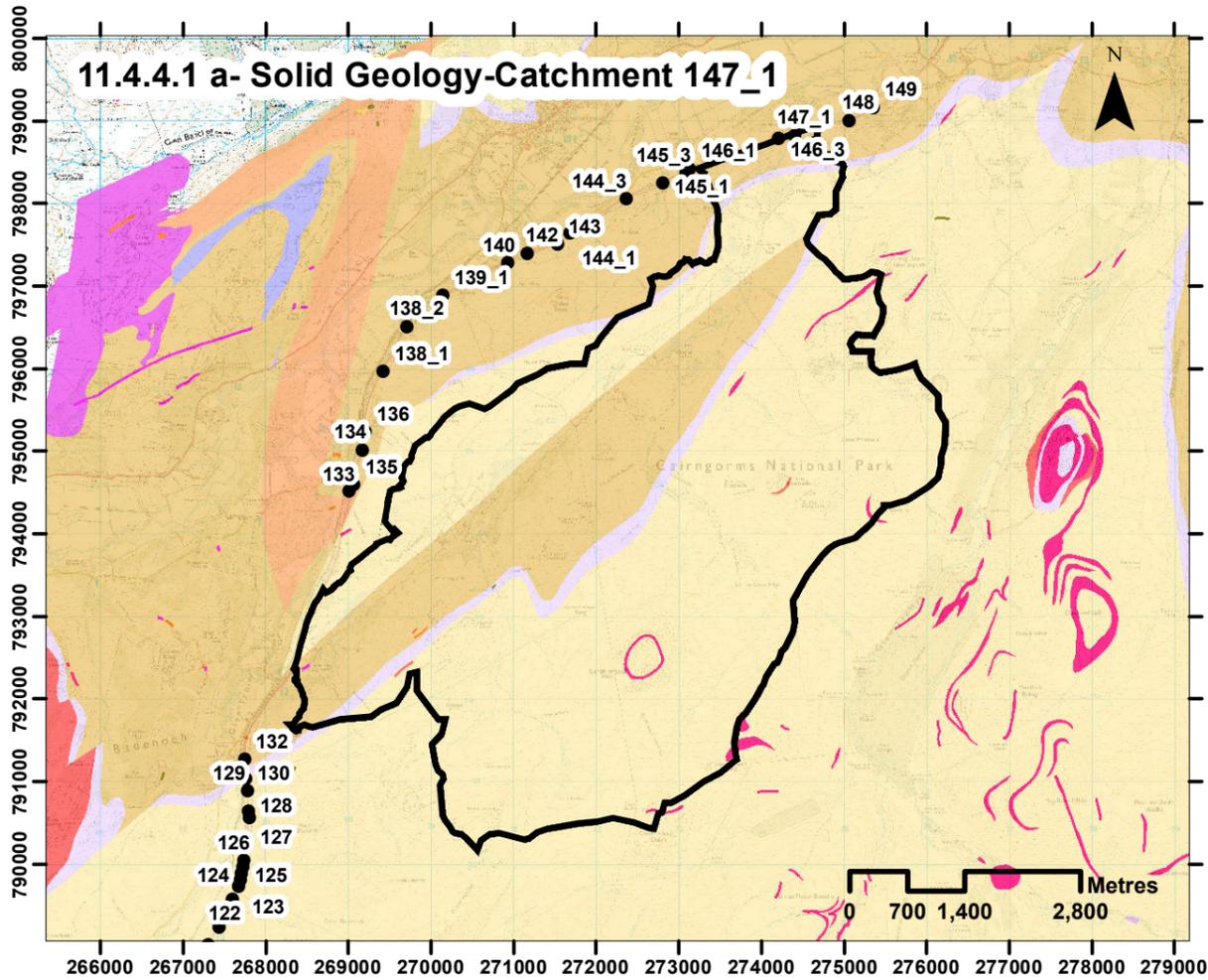
PROJECT 9 CRUBENMORE TO KINCRAIG EIA
DRAWING 11.4.4.2.
Catchment 146_1 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	AB	EL	EL

DATE: 19/12/2017
PROJ: 495298
DWG: A9P09-CFJ-EWE-Z_ZZZZ_ZZ-DR-EN-0010
SHEET: 1 OF 1
REVISION: C01
SUITABILITY: A3

Annex 11.4.4-Hydromorphological Catchment Assessment-147_1

Catchment No.	147_1		
Catchment Name	Milton Burn		
Channel Nature	Nature of water course Size of water course	Natural Major	
Quantitative Spatial Elements	Catchment Area (km ²) Average slope in catchment (‰) % Catchment over 750m (for snow melt risk)	35 6 0	
WFD classification	Water, flows and levels Physical condition Overall ecological status	High Good Good	
Geology	Majority Bedrock (see Drawing 11.4.4.1 a and b, Catchment 147_1) Is an alluvial fan present at or near the crossing?	Loch Laggan Psammite formation- Psammite, Micaceous No	resistant to weathering, impermeable
Environmental designations (see Drawing 11.4.4.1 c, Catchment 147_1)	Ramsar SAC SPA SSSI	No Yes Yes Yes	River Spey Atlantic salmon, freshwater pearl mussel, otter, sea lamprey River Spey - Insh Marshes Hen Harrier, Osprey breeding, Spotted Crane breeding, Whooper swan, Wigeon breeding, Wood Sandpiper Loch Etteridge Quaternary of Scotland
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.4.2, Catchment 147_1	
	Is peat present in the catchment?	Yes	BGS 1:50k shows extensive peat present in upper catchment, most likely blanket peat. This is also evident in Google Earth Imagery which also shows extensive networks of drains cut into the peat. At least 3 features on flanks of main valley which may be peatslide or bog burst scars. Based on this other failures could occur and supply large amounts of sediment to the floodplain and or channel in the mid-catchment. Upper catchment peat unlikely to be a high risk as connectivity to main channel is limited and no scars of previous failures are evident.
	Is there a bog burst risk?	Yes	2 identified individually in lower catchment, one particularly large
	Current valley side or terrace erosion	Yes	c.3km of potential eroding valley side
	Potential valley side or terrace erosion	Yes	1 possible shallow landslides (possibly initiating as peatslide)
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	Yes	Lower catchment shows evidence of channel migration, including a reach of multithread mobile channel.
	Unvegetated bars	Yes	Mid-catchment has a reach with multiple unvegetated bars visible in Google Earth
Wooded/forested areas in catchment	Yes	Riparian woodland along most of the bank length in mid and lower catchment. Small coniferous plantation woodland in uppermost part of catchment.	
Infrastructure type (see Drawing 11.4.4.1 d, Catchment 147_1)	Yes	Several fords and footbridges in mid and upper catchment including historic General Wade's military road bridges. Several farms/hamlets throughout main valley	
Comment on sediment source potential in catchment	Very high. Numerous sources of sediment including from shallow failure and possible bog burst, valley side erosion and mobile sediment in channel and erodible floodplain deposits.		
Comment on sediment supply potential to crossing	High - many sources of sediment well connected to the channel (including eroding valley sides, erodible flood plain deposits and possible shallow failures on main valley sides) and there seem to be frequent unvegetated bars of mobile sediment visible in the mid and lower catchment. Relatively flat area in lower catchment may put a check on transfer to the crossing, and sediment may only reach crossing from upper catchment after several high magnitude events, but nonetheless connectivity is good and retaining a crossing that can handle the delivery of large amounts of sediment is required.		
Morphology and Process Reach upstream of crossing	Channel morphology	Meandering	
	Predominant sediment size	Gravel	
	Unvegetated bars	Yes	
	Vertical incision	Low	
	Deposition	Medium	
	Lateral migration/bank erosion	High	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 147_1)	None	
	Impact of infrastructure	None	
Channel realignment	Yes		
Morphology and Process At crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	No	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 147_1)	None	
Morphology and Process Reach downstream of crossing	Channel morphology	Plane-Riffle	
	Predominant sediment size	Gravel	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 147_1)	Yes	
	Impact of infrastructure	Yes	
Channel realignment	Yes		
Summary behaviour	Limited activity in this catchment. Limited realignment u/s of crossing. Seems stable and vegetated. D/s of crossing realigned, probably during railway construction to take flow from this and other channels through just one point along the railway embankment.		



Legend

General

- Crossing location

Solid Geology

- Gaick Psammite Formation - Psammite
- Loch Laggan Psammite Formation - Psammite, Micaceous
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite
- Pitmain Semipelite Member - Semipelite And Calcsilicate-Rock
- Pitmain Semipelite Member - Semipelite, Gneissose
- Scottish Highland Ordovician Minor Intrusion Suite - Leucogranite
- Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite- (Other Than Dykes) - Microdiorite

Drift Geology

- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardrverkie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

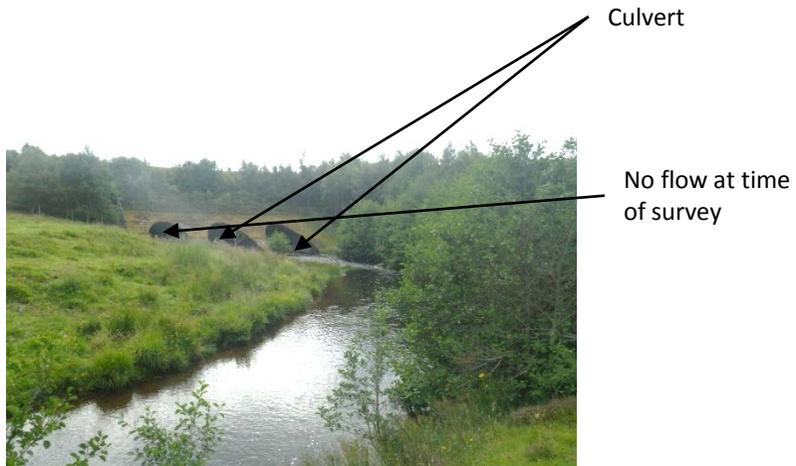
Environmental Designations

- Ramsar
- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area
- National Nature Reserve

Morphological Pressures

- ▲ Railway Bridge
- ▲ Road Bridge
- ▲ Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Ford
- ◆ Dam or Weir
- Discharge Location
- Abstraction Location
- Drainage Ditch
- Flood Embankment
- Power Lines
- Road Embankment

REV	SUIT	DATE	DESCRIPTION	BY	APP
<p>ch2m FAIRHURST</p> <p>CH2MHILL Fairhurst JV C/O: City Park 368 Alexandra Parade Glasgow G31 3AU Tel +44 (0) 141 552 2000 Fax +44 (0) 141 552 2525</p>					
<p>9 CRUBENMORE TO KIN CRAIG EIA</p> <p>Drawing 11.4.4.1 Catchment 147_1 Catchment Overview</p>					
DESIGN:	EL	DRAWN:	EV	CHK:	EL
APP:	EL				
DATE: 20/12/2017					
PROJ: 495298					
DWG: A9P09-CFJ-EWE-Z_72772_ZZ-DR-EN-0009					
SHEET:	1 of 1	REVISION:	C01	SUITABILITY:	A3



Photograph 11.4.4.22- Upstream



Photograph 11.4.4.23 -Downstream



Photograph 11.4.4.24



Photograph 11.4.4.25- Downstream



Moorland
catchment

Photograph 11.4.4.26-Upstream to catchment

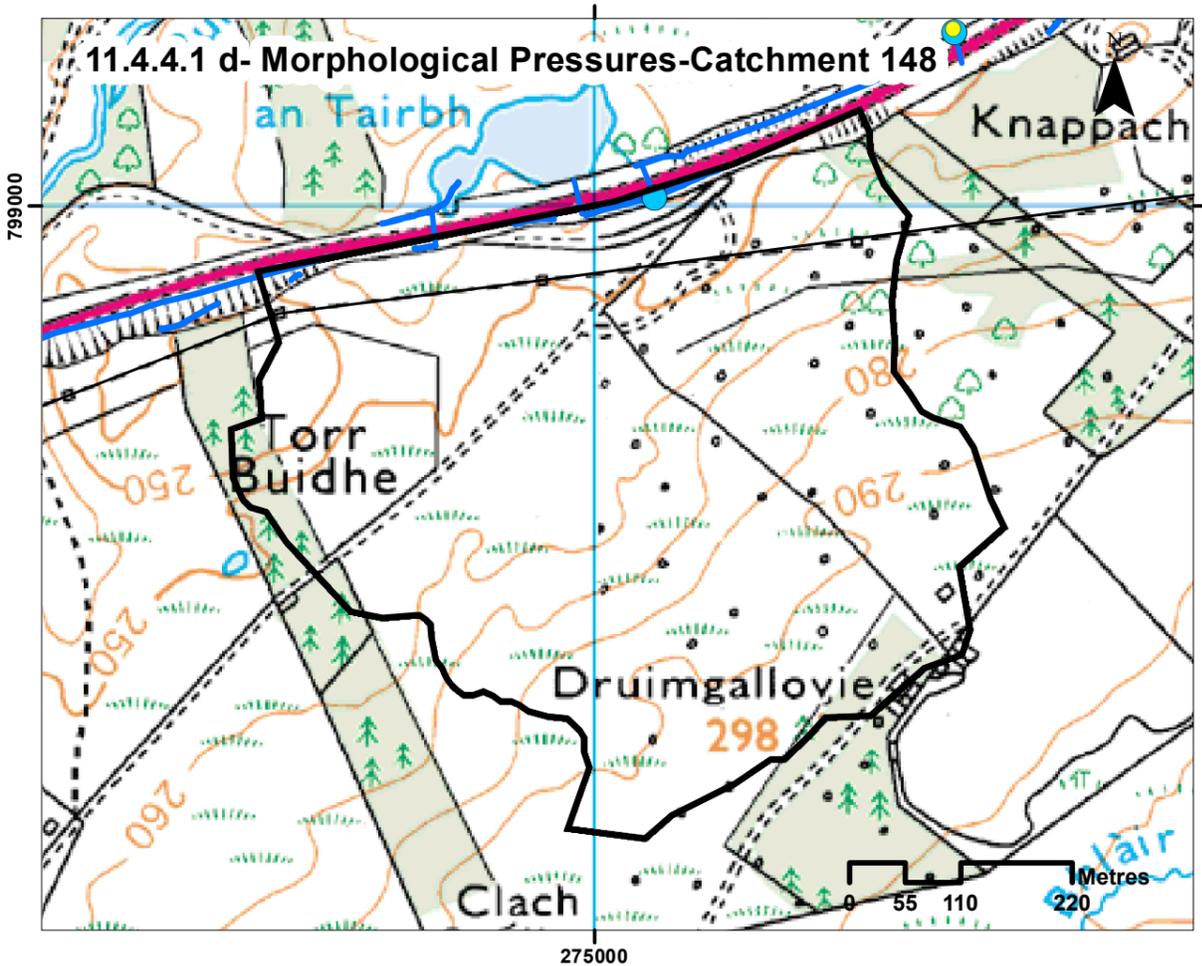
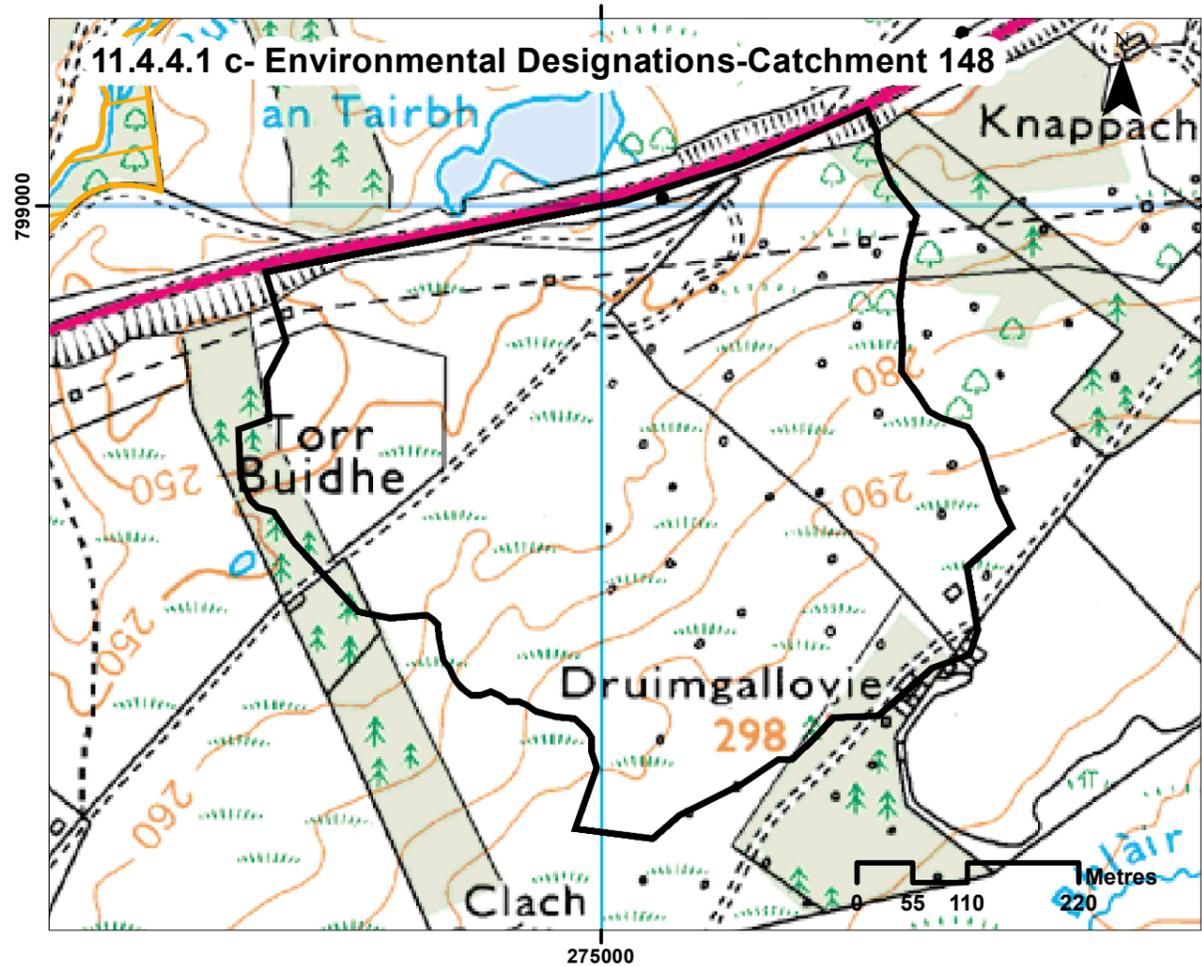
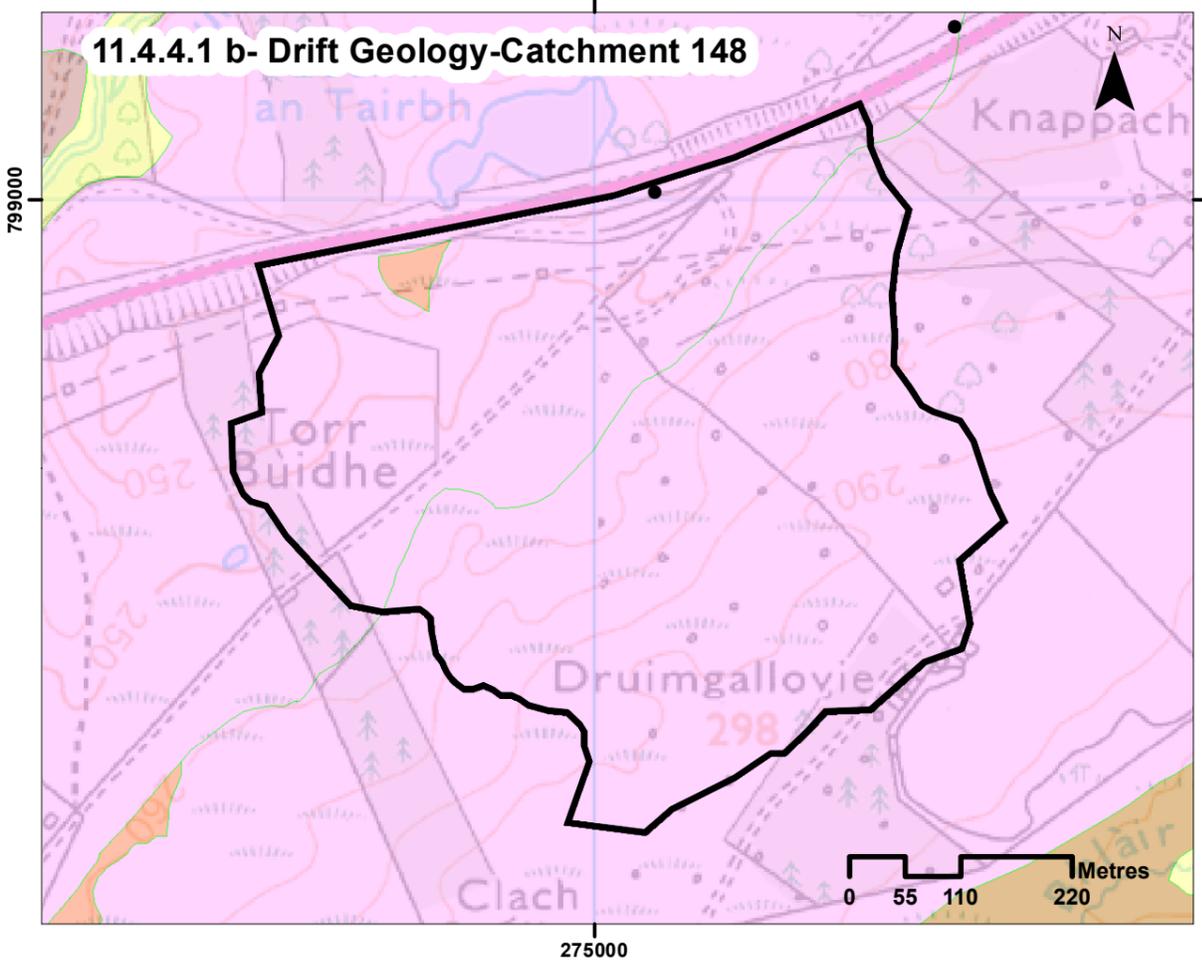
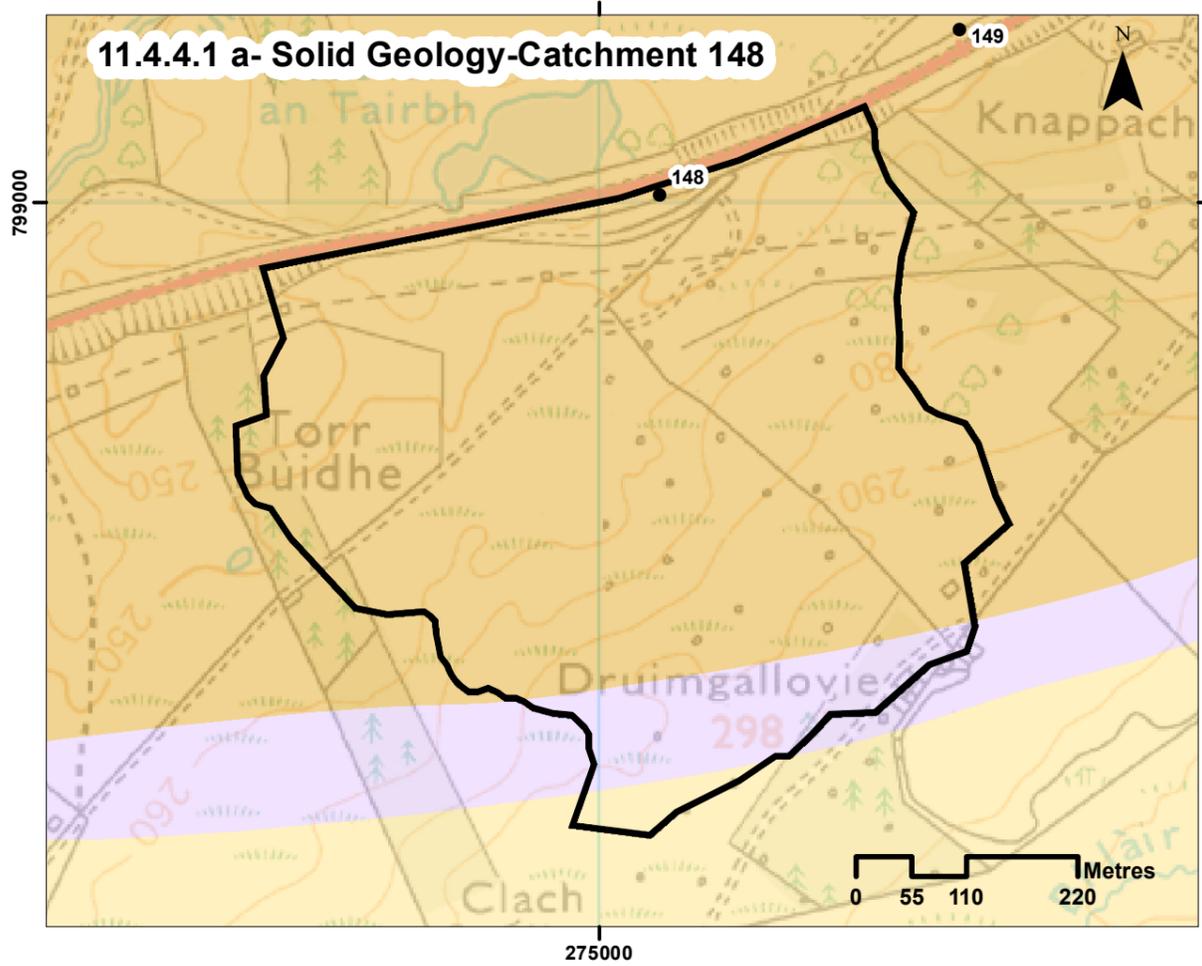


Tree lined
channel

Photograph 11.4.4.27-Upstream to catchment

Annex 11.4.4-Hydromorphological Catchment Assessment-148

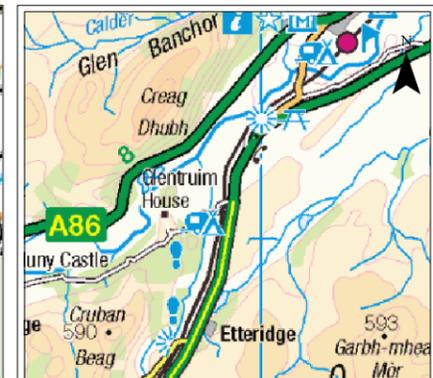
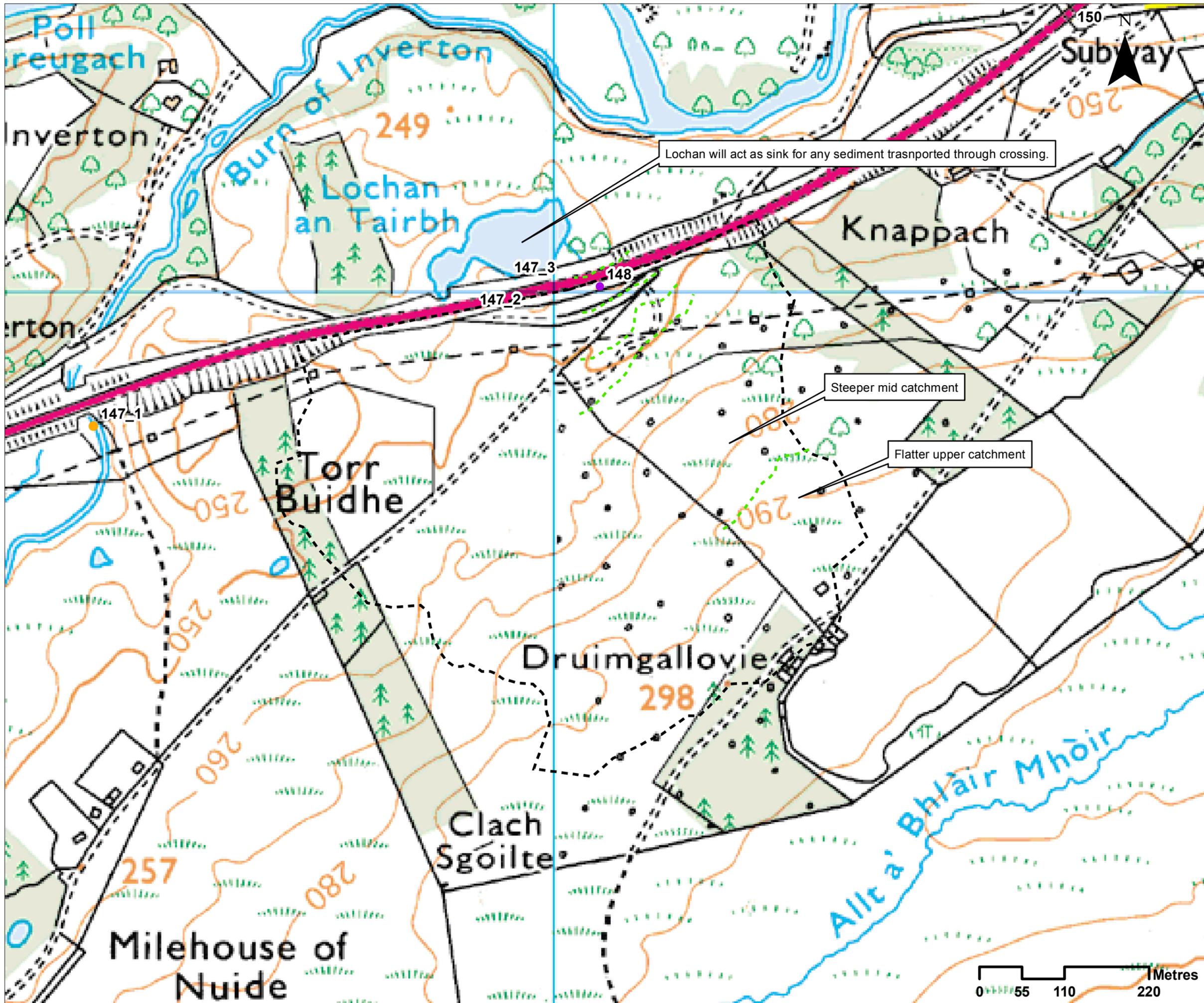
Catchment No.	148		
Catchment Name	-		
Channel Nature	Nature of water course	Natural	
	Size of water course	Minor	
Quantitative Spatial Elements	Catchment Area (km ²)	0.3	
	Average slope in catchment (°)	6	
	% Catchment over 750m (for snow melt risk)	0	
WFD classification	Water, flows and levels	Good	
	Physical condition	Good	
	Overall ecological status	Good	
Geology	Majority Bedrock (see Drawing 11.4.4.1 a and b Catchment 148)	Loch Laggan Psammite formation- Psammite, Micaceous	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	
Environmental designations (see Drawing 11.4.4.1 c, Catchment 148)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.4.2, Catchment 148	
	Is peat present in the catchment?	Yes	
	Is there a bog burst risk?	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	Possible bog burst/slide scar. Advise further investigation on site to confirm presence of peat and how morphology looks on the ground.
	Hill slope failures coupled to channel	Yes	If bog burst scar is confirmed, no if not.
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	Yes	Plantation forestry in upper catchment, scrub woodland in lower catchment
	Infrastructure type (see Drawing 11.4.4.1 d, Catchment 148)	Yes	ETL
	Comment on sediment source potential in catchment	Limited, unless previous peat instability is confirmed. If confirmed, potential for major supply of organic sediment and scour of substrate.	
Comment on sediment supply potential to crossing	Limited, unless instability described above is confirmed		
Morphology and Process- Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Gravel (large and small)	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 148)	No	
	Impact of infrastructure	No	
	Channel realignment	No	
Morphology and Process- At crossing	Channel morphology	Engineered	Unclear from photos
	Predominant sediment size	Small gravel	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	No	
Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	Possibly artificially cut through soil to substrate
	Predominant sediment size	Small gravel	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 148)	Yes	Not really infrastructure but there is a lochan immediately d/s of the crossing.
	Impact of infrastructure	Yes	
Channel realignment	No		
Summary behaviour	Limited activity in this catchment. Limited realignment u/s of crossing. Seems stable and vegetated. D/s of crossing realigned, probably during railway construction to take flow from this and other channels through just one point along the railway embankment.		



- Legend**
- General**
- Crossing location
- Solid Geology**
- Gaik Psammite Formation - Psammite
 - Loch Laggan Psammite Formation - Psammite, Micaceous
 - North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite
 - Pitmain Semipelite Member - Semipelite And Calcsilicate-Rock
 - Pitmain Semipelite Member - Semipelite, Gneissose
 - Scottish Highland Ordovician Minor Intrusion Suite - Leucogranite
 - Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite- (Other Than Dykes) - Microdiorite
- Drift Geology**
- Peat
 - Glaciofluvial Ice Contact Deposits
 - Gaik Plateau Moraine Formation
 - Hummocky Glacial Deposits
 - Ardrverkie Till Formation - Diamicton
 - Glaciofluvial Sheet Deposits
 - Alluvium
 - River Terrace Deposits
 - Alluvial Fan Deposits
 - Head
 - Talus - Rock Fragments
 - Talus Cone
- Environmental Designations**
- Special Area of Conservation
- Morphological Pressures**
- Culvert
 - Catchpit
 - Drainage Ditch
 - Power Lines

REV	SUIT	DATE	DESCRIPTION	BY	APP
<p>ch2m FAIRHURST</p> <p>CH2MHILL Fairhurst JV C/O: City Park 368 Alexandra Parade Glasgow G31 3AU Tel + 44 (0) 141 552 2000 Fax +44 (0) 141 552 2525</p>					
<p>A9 DUALING PERTH TO INVERNESS Crumrackie to Kinraig</p>					
<p>9 CRUBENMORE TO KINRAIG EIA</p> <p>Drawing 11.4.4.1 Catchment 148 Catchment Overview</p>					
DESIGN: EL	DRAWN: EV	CHK: EL	APP: EL		
DATE: 20/12/2017					
PROJ: 495298					
DWG: A9P09-CFJ-EWE-Z_22222_ZZ-DR-EN-0009					
SHEET: 1 of 1	REVISION: C01	SUITABILITY: A3			

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Legend

- Major crossing
- Minor crossing
- Other crossing
- - - Break in slope
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

ch2m: FAIRHURST
 CH2MHILL Fairhurst JV
 C/O: City Park 368 Alexandra Parade Glasgow G31 3AU
 Tel + 44 (0) 141 552 2000 Fax +44 (0) 141 552 2525



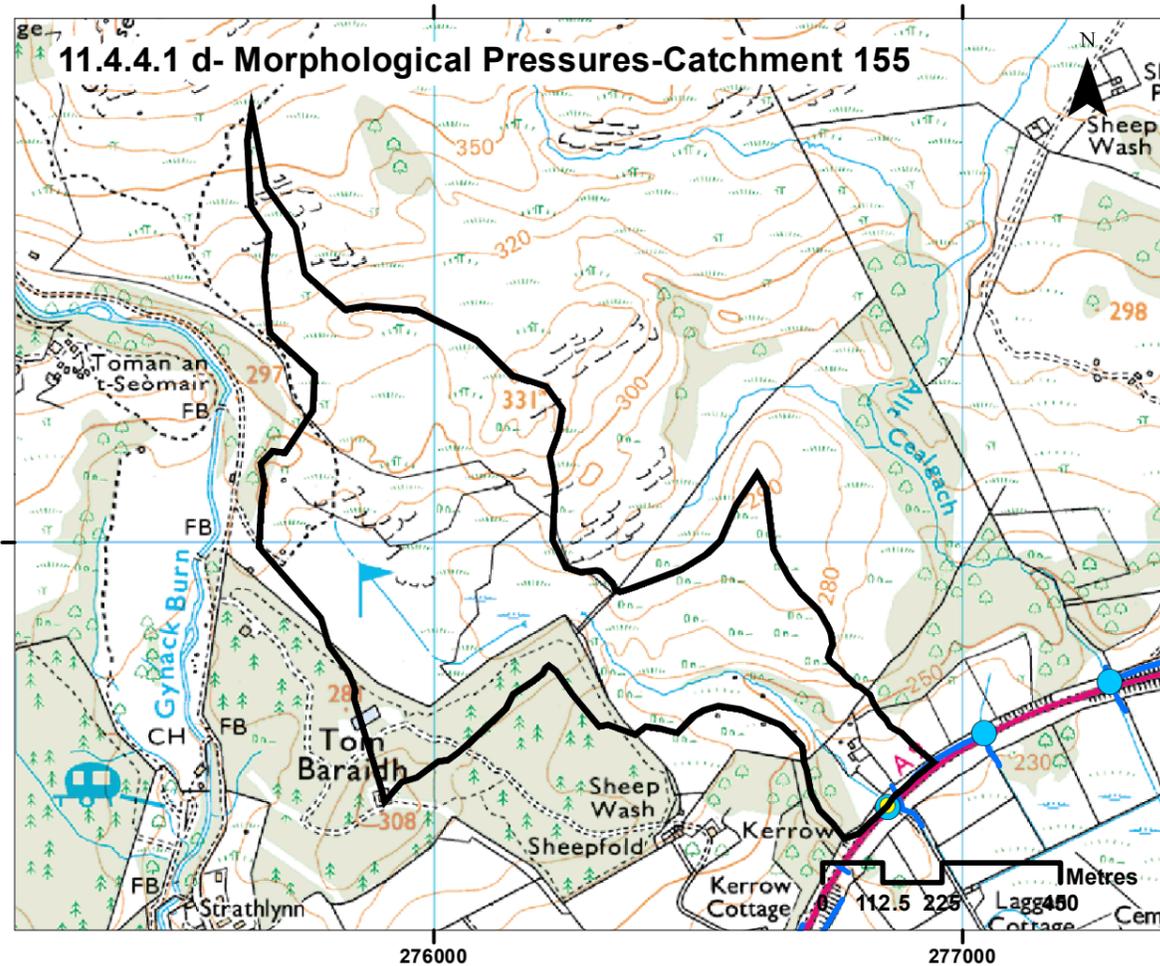
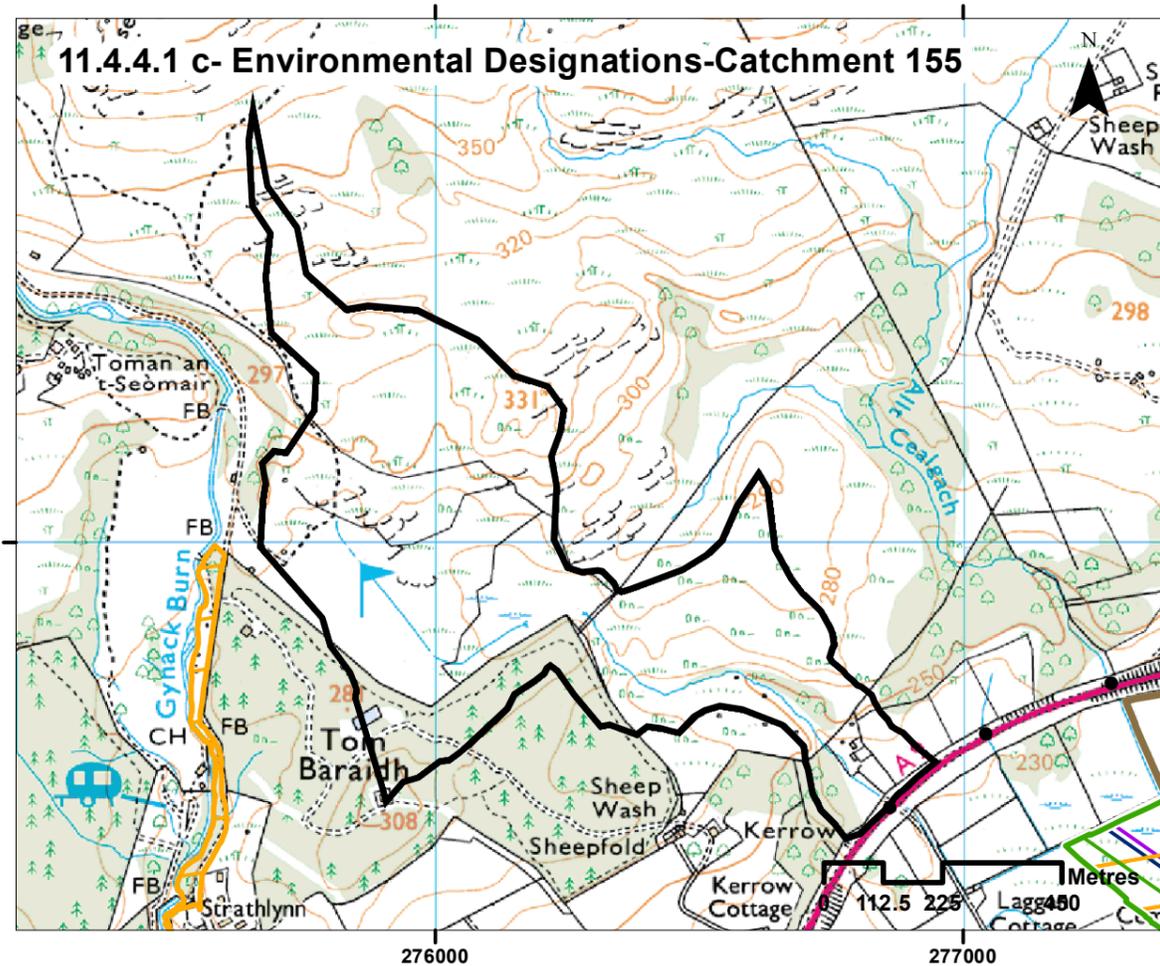
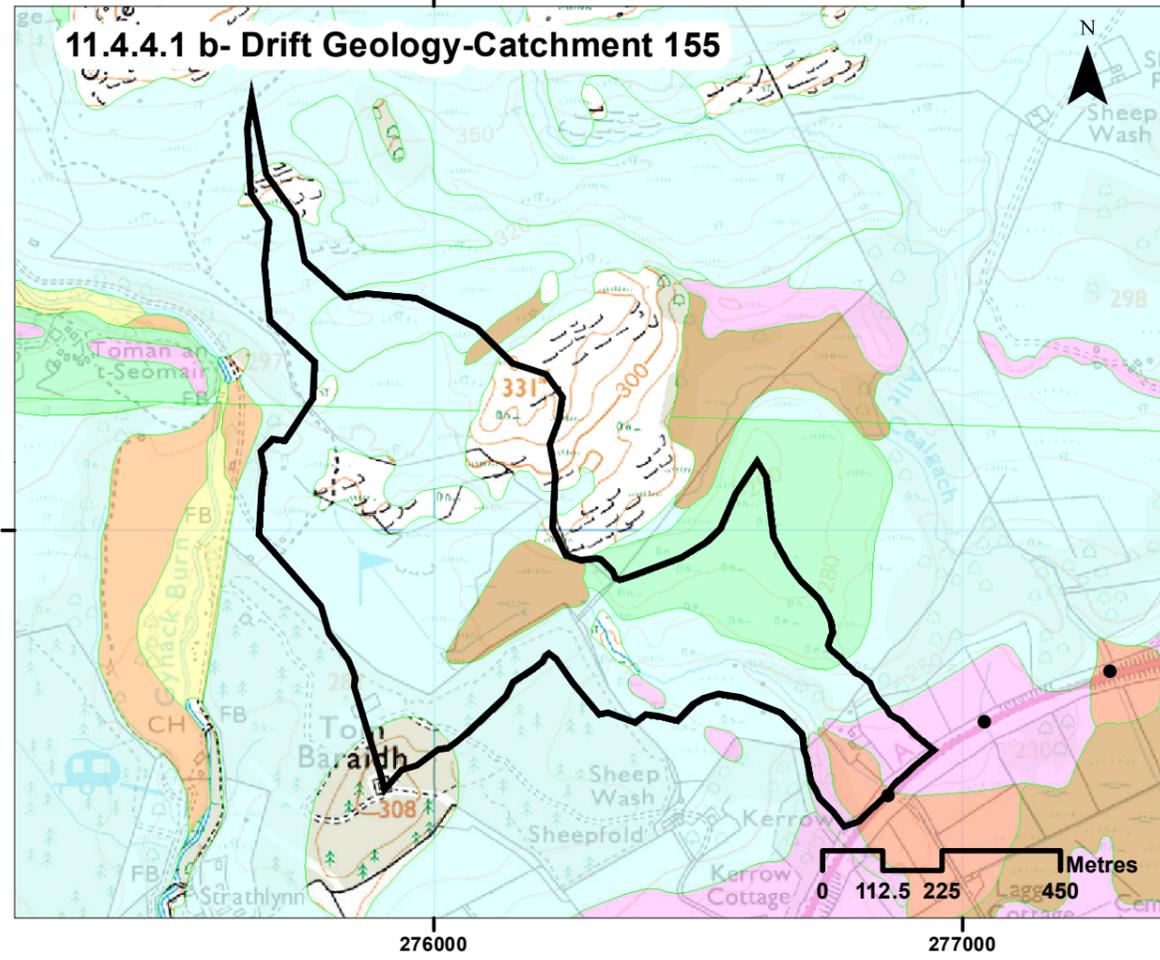
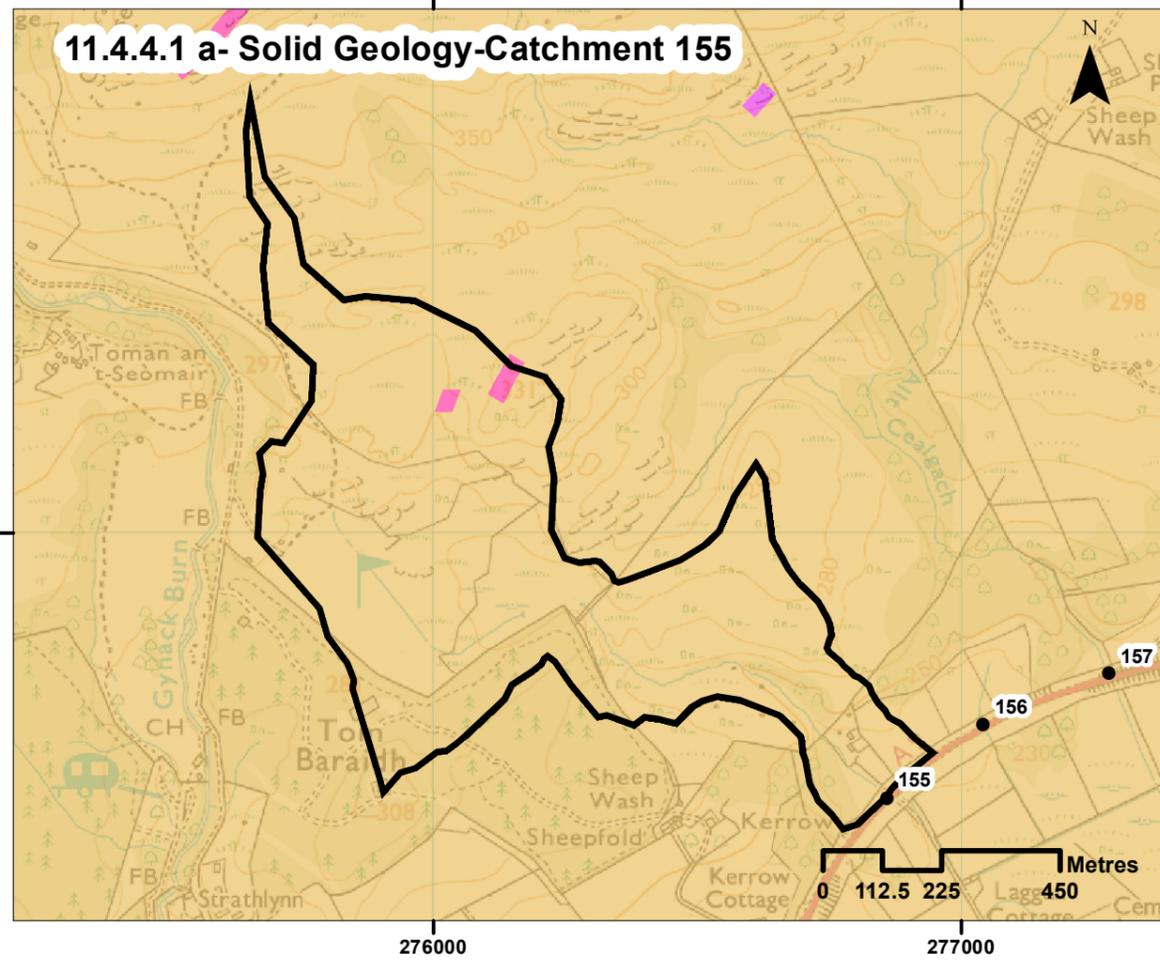
PROJECT 9 CRUBENMORE TO KINCRAIG EIA
DRAWING 11.4.4.2.
Catchment 148 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	AB	EL	EL

DATE: 03/01/2018	PROJ: 495298
DWG: A9P09-CFJ-EWE-Z_ZZZZ_ZZ-DR-EN-0010	
SHEET: 1 OF 1	SUITABILITY: A3

Annex 11.4.4-Hydromorphological Catchment Assessment-155

Catchment No.	155		
Catchment Name	-		
Channel Nature	Nature of water course Size of water course	Natural Major	
Quantitative Spatial Elements	Catchment Area (km ²) Average slope in catchment (°) % Catchment over 750m (for snow melt risk)	0.6 5 0	
WFD classification	Water, flows and levels Physical condition Overall ecological status	Good Good Good	
Geology	Majority Bedrock (see Drawing 11.4.4.1 a and b Catchment 155) Is an alluvial fan present at or near the crossing?	Loch Laggan Psammite formation- Psammite, Micaceous Yes	resistant to weathering, impermeable Risk of avulsion. Substantial alluvial fan is a relict from when this was a glacial meltwater channel, rather than currently active.
Environmental designations (see Drawing 11.4.4.1 c, Catchment 155)	Ramsar SAC SPA SSSI	Yes No No No	Drains into River Spey - Insh Marshes Breeding birds, wetlands, freshwater habitats, trophic range river/stream, Whooper Swan
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement Is peat present in the catchment? Is there a bog burst risk? Current valley side or terrace erosion Potential valley side or terrace erosion Hill slope failures (including peat slides and debris flows and slides) Hill slope failures coupled to channel Vertical incision present in catchment Bank erosion/lateral migration Unvegetated bars Wooded/forested areas in catchment Infrastructure type (see Drawing 11.4.4.1 d, Catchment 155) Comment on sediment source potential in catchment Comment on sediment supply potential to crossing	See Drawing 11.4.4.2, Catchment 155 Yes Yes No No No No No No No Yes Yes Limited - no obvious sediment sources No evidence at crossing of major potential for sediment transport.	Very small deposits Unlikely but peaty area at lower end of golf course with pond Some plantation forestry Golf course, dam - probably capturing some flow from golf course area
Morphology and Process- Reach upstream of crossing	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 155) Impact of infrastructure Channel realignment	Engineered Fine No Low Low Low Yes Yes Yes	Appears straightened Possibly incised but more likely cut and straightened. Appears stable Buildings and yard on left bank immediately u/s of crossing, plus access track Possible source of run-off and sediment Appears straightened
Morphology and Process- At crossing	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Damaged/unstable drains or armouring	Engineered Fine No None Low None No	Pipe culvert with concrete inflow Minor deposition in culvert
Morphology and Process- Reach downstream of crossing	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 155) Impact of infrastructure Channel realignment	Engineered Fine No Low Low None Yes No Yes	 Farm buildings Channel probably realigned prior to railway construction (straightened and right angle bends introduced) as has same, unnatural plan form on 1903 map as present day.
Summary behaviour	Limited activity in this catchment. Limited realignment u/s of crossing. Seems stable and vegetated. D/s of crossing realigned, probably during railway construction to take flow from this and other channels through just one point along the railway embankment.		



- ## Legend
- General**
- Crossing location
- Solid Geology**
- Gaick Psammite Formation - Psammite
 - Loch Laggan Psammite Formation - Psammite, Micaceous
 - North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite
 - Pitmain Semipelite Member - Semipelite And Calcsilicate-Rock
 - Pitmain Semipelite Member - Semipelite, Gneissose
 - Scottish Highland Ordovician Minor Intrusion Suite - Leucogranite
 - Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite- (Other Than Dykes) - Microdiorite
- Drift Geology**
- Peat
 - Glaciofluvial Ice Contact Deposits
 - Gaick Plateau Moraine Formation
 - Hummocky Glacial Deposits
 - Ardverkie Till Formation - Diamicton
 - Glaciofluvial Sheet Deposits
 - Alluvium
 - River Terrace Deposits
 - Alluvial Fan Deposits
 - Head
 - Talus - Rock Fragments
 - Talus Cone
- Environmental Designations**
- Ramsar
 - Special Site of Scientific Interest
 - Special Area of Conservation
 - Special Protection Area
 - National Nature Reserve
- Morphological Pressures**
- Culvert
 - Catchpit
 - Drainage Ditch

REV	SUIT	DATE	DESCRIPTION	BY	APP
<p>ch2m FAIRHURST</p> <p>CH2MHILL Fairhurst JV C/O: City Park 368 Alexandra Parade Glasgow G31 3AU Tel + 44 (0) 141 552 2000 Fax +44 (0) 141 552 2525</p>					
<p>A9 TRANSPORT SCOTLAND PERTH TO INVERNESS CRUBENMORE TO KINRAIG</p>					
<p>9 CRUBENMORE TO KINRAIG EIA</p> <p>Drawing 11.4.4.1 Catchment 155 Catchment Overview</p>					
DESIGN: EL	DRAWN: EV	CHK: EL	APP: EL		
DATE: 20/12/2017					
PROJ: 495298					
DWG: A9P09-CFJ-EWE-Z_77777_77-DR-EN-0009					
SHEET: 1 of 1	REVISION: C01	SUITABILITY: A3			

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Channel
along fence
line

Photograph 11.4.4.28



Photograph 11.4.4.29



Some flow

Photograph 11.4.4.30- Crossing exit

Entrance to
crossing



Photograph 31

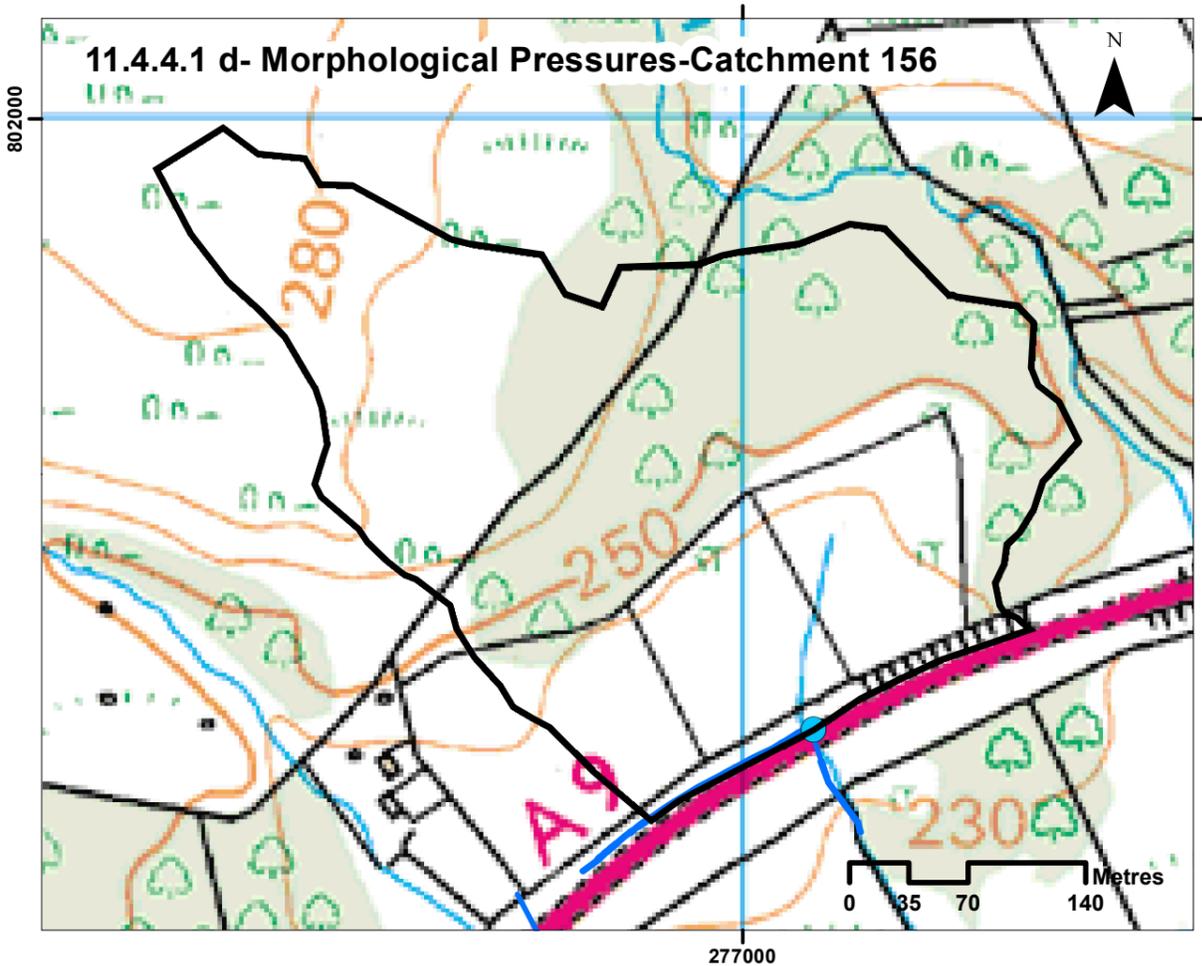
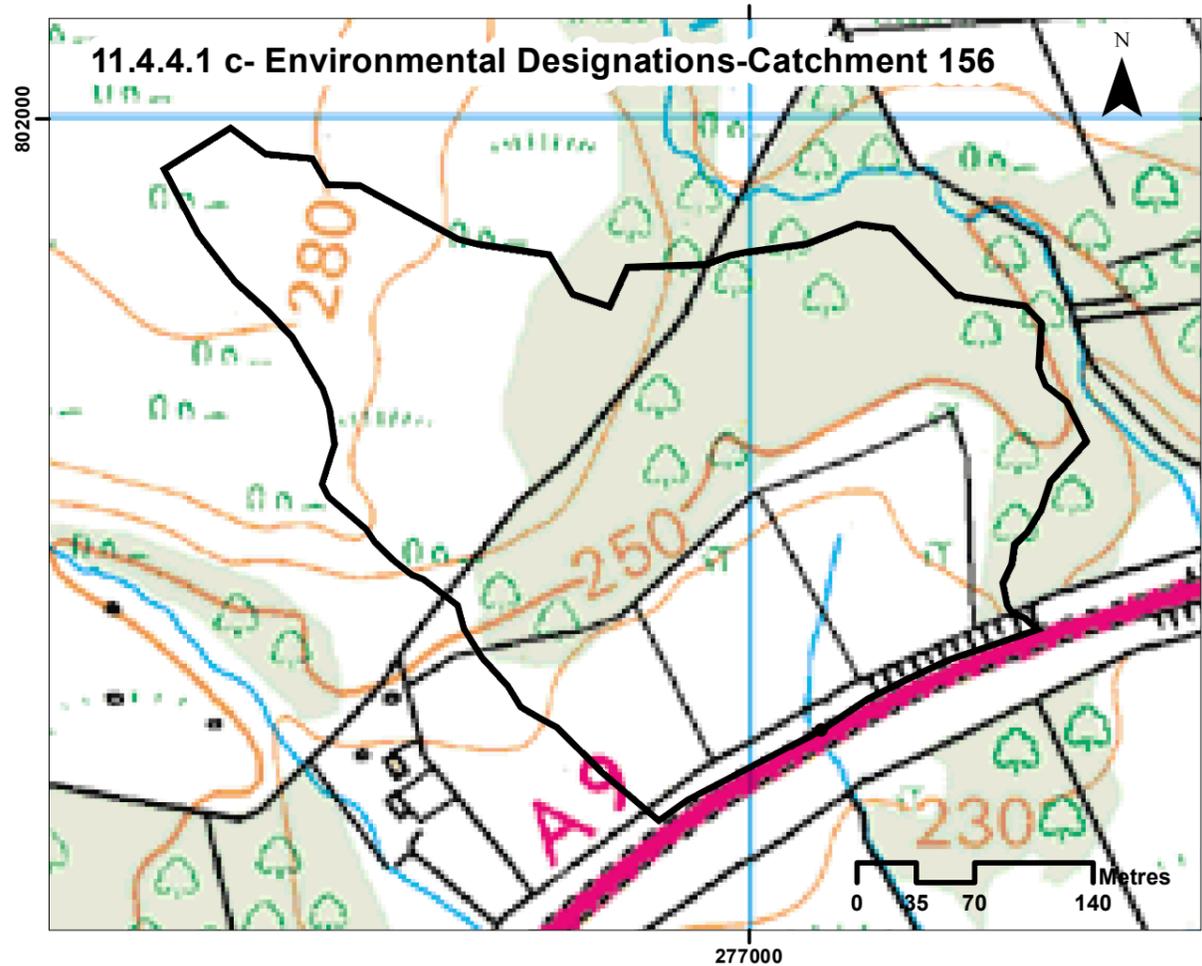
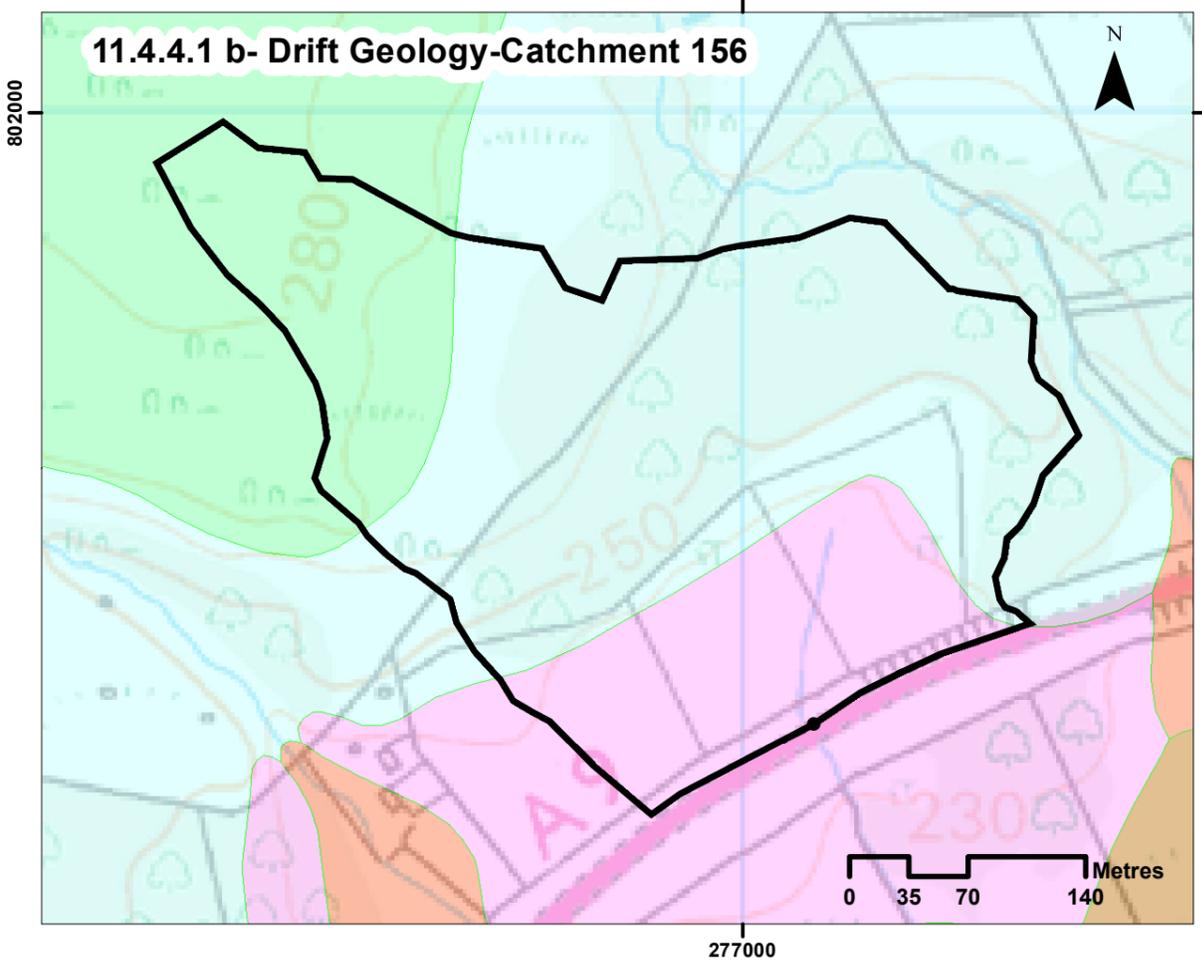
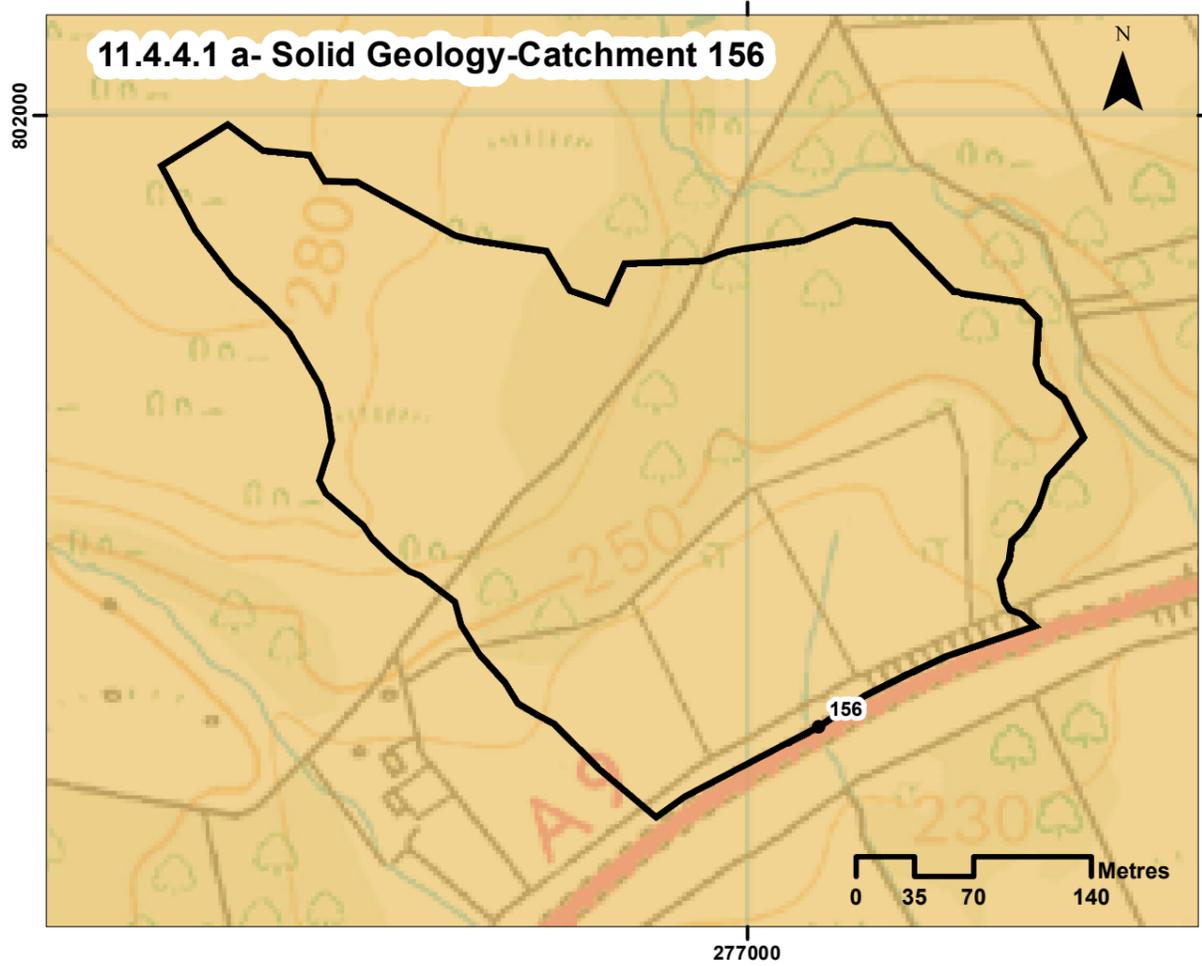


Concrete
channel
leading to
crossing

Photograph 11.4.4.32

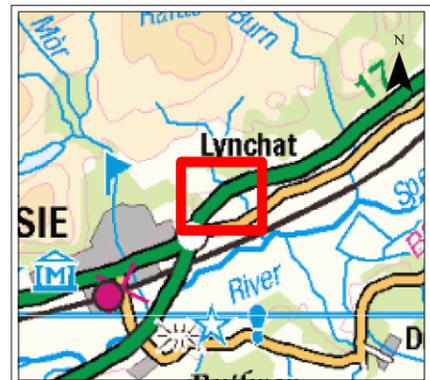
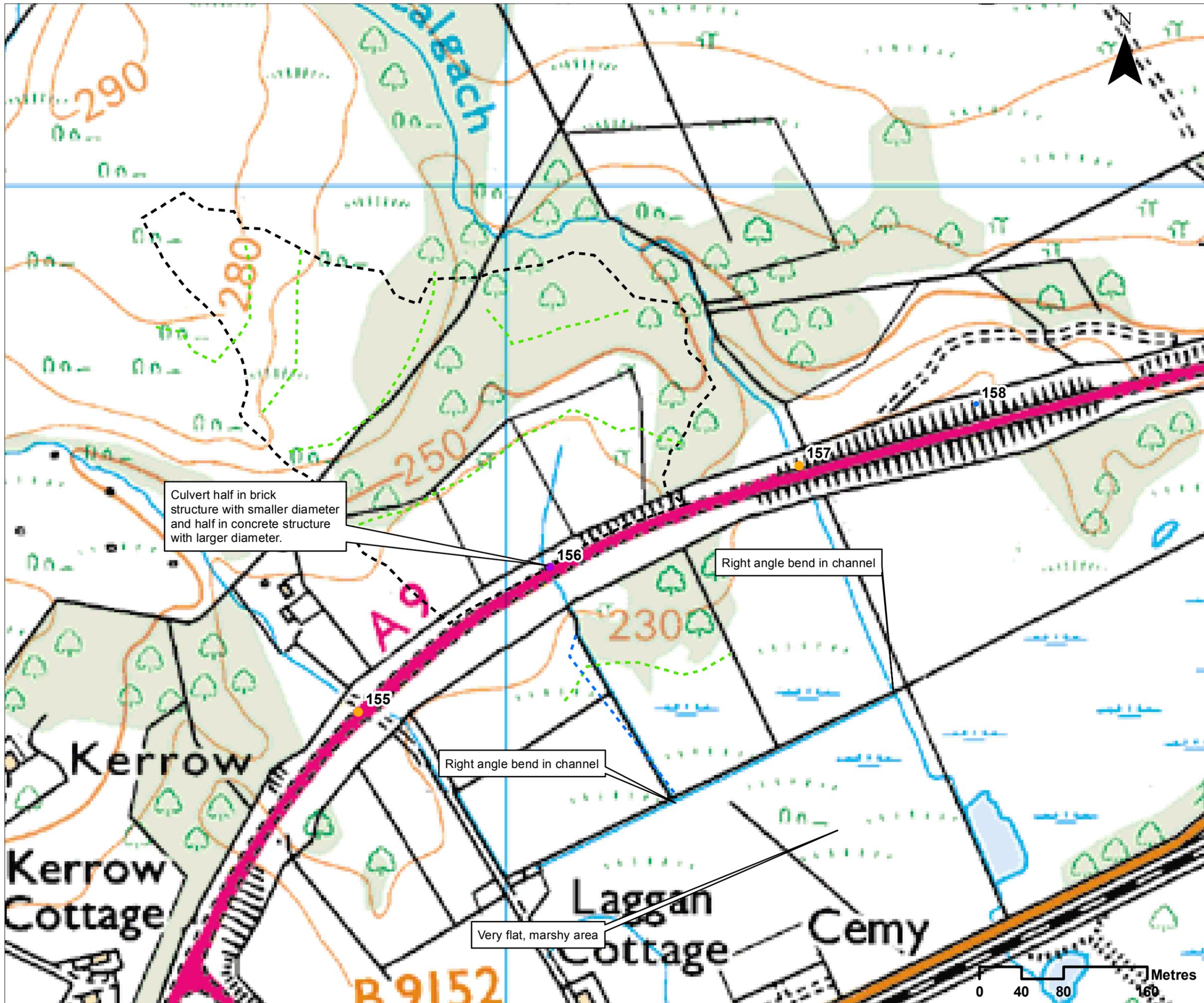
Annex 11.4.4-Hydromorphological Catchment Assessment-156

Catchment No.	156		
Catchment Name	-		
Channel Nature	Nature of water course	Natural	
	Size of water course	Minor	
Quantitative Spatial Elements	Catchment Area (km ²)	0.6	
	Average slope in catchment (°)	6	
	% Catchment over 750m (for snow melt risk)	0	
WFD classification	Water, flows and levels	Good	
	Physical condition	Good	
	Overall ecological status	Good	
Geology	Majority Bedrock (see Drawing 11.4.4.1 a and b Catchment 156)	Loch Laggan Psammite formation- Psammite, Micaceous	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	Water may come into crossing along the embankment toe from 155 at high flows and from approx 350m upstream from 157.
Environmental designations (see Drawing 11.4.4.1 c, Catchment 156)	Ramsar	Yes	Drains into River Spey - Insh Marshes
	SAC	No	Breeding birds, wetlands, freshwater habitats, trophic range river/stream, Whooper Swan
	SPA	No	
	SSSI	No	
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.4.2, Catchment 156	
	Is peat present in the catchment?	Yes	Lower catchment is floodplain mire
	Is there a bog burst risk?	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
Wooded/forested areas in catchment	Yes	Deciduous woodland on steeper slope	
Infrastructure type (see Drawing 11.4.4.1 d, Catchment 156)	No		
Comment on sediment source potential in catchment	Limited. No obvious significant sources. Some cattle poaching visible in aerial photos.		
Comment on sediment supply potential to crossing	Fine deposition evident from engineer's site photos.		
Morphology and Process- Reach upstream of crossing	Channel morphology	Engineered	Cut drain
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 156)	No	
	Impact of infrastructure	No	
	Channel realignment	Yes	Some straightening immediately u/s of cutting
Morphology and Process- At crossing	Channel morphology	Engineered	Pipe culverts, seemingly constructed at two separate points as engineers photos show one built within brick structure and one built in concrete structure with wider diameter
	Predominant sediment size	fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	No	Culvert seems intact
Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	Straightened
	Predominant sediment size	-	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 156)	Yes	Pipe crosses channel several metres d/s of crossing. Fence across channel too. Possibility that pipe could snarl woody debris (if that debris could get past the crossing, damming channel).
Impact of infrastructure	Yes	Seems to be a slight straightening realignment of channel since railway crossing and also has been realigned prior to 1903 map (straightened and right angle bends introduced).	
Channel realignment	Yes		
Summary behaviour	Limited activity in this catchment. Limited realignment u/s of crossing. Seems stable and vegetated. D/s of crossing realigned, probably during railway construction to take flow from this and other channels through just one point along the railway embankment.		



- Legend**
- General**
- Crossing location
- Solid Geology**
- Loch Laggan Psammite Formation - Psammite, Micaceous
- Drift Geology**
- Peat
 - Glaciofluvial Ice Contact Deposits
 - Gaick Plateau Moraine Formation
 - Hummocky Glacial Deposits
 - Ardverkie Till Formation - Diamicton
 - Glaciofluvial Sheet Deposits
 - Alluvium
 - River Terrace Deposits
 - Alluvial Fan Deposits
 - Head
 - Talus - Rock Fragments
 - Talus Cone
- Morphological Pressures**
- Culvert
 - Drainage Ditch

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<p>ch2m FAIRHURST CH2MHILL Fairhurst JV C/O: City Park 368 Alexandra Parade Glasgow G31 3AU Tel + 44 (0) 141 552 2000 Fax +44 (0) 141 552 2525</p>					
<p>TRANSPORT SCOTLAND A9 DUALING PERTH TO INVERNESS Crubenmore to Kinraig</p>					
<p>9 CRUBENMORE TO KINRAIG EIA</p>					
<p>Drawing 11.4.4.1 Catchment 156 Catchment Overview</p>					
DESIGN: EL	DRAWN: EV	CHK: EL	APP: EL		
DATE: 20/12/2017					
PROJ: 495298					
DWG: A9P09-CFJ-EWE-Z_77777_ZZ-DR-EN-0009					
SHEET: 1 of 1	REVISION: C01	SUITABILITY: A3			



Legend

- Major crossing
- Minor crossing
- Other crossing
- - - Break in slope
- - - Original channel
- Crossing catchment

Culvert half in brick structure with smaller diameter and half in concrete structure with larger diameter.

Right angle bend in channel

Right angle bend in channel

Very flat, marshy area

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 9 CRUBENMORE TO KINCRAIG EIA
DRAWING 11.4.4.2
Catchment 156 Baseline Assessment

DESIGN: EL	DRAWN: AB	CHK: EL	APP: EL
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DATE: 19/12/2017
 PROJ: 495298
 DWG: A9P09-CFJ-EWE-Z_ZZZZ_ZZ-DR-EN-0010

SHEET: 1 OF 1	REVISION: C01	SUITABILITY: A3
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Culvert entrance

Photograph 11.4.4.33



Photograph 11.4.4.34-Catchment



Culvert exit

Photograph 11.4.4.35

Downstream from crossing

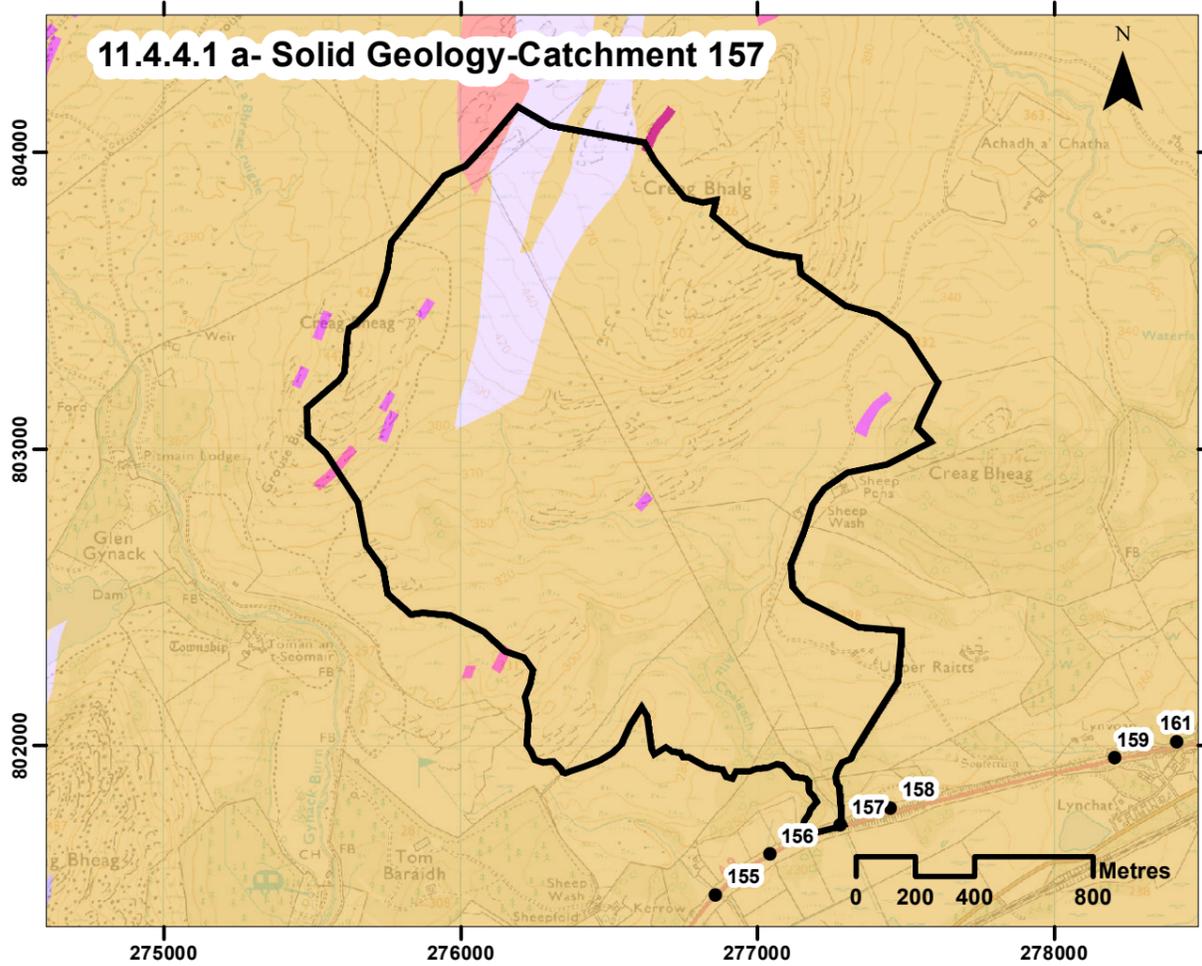


Photograph 11.4.4.36

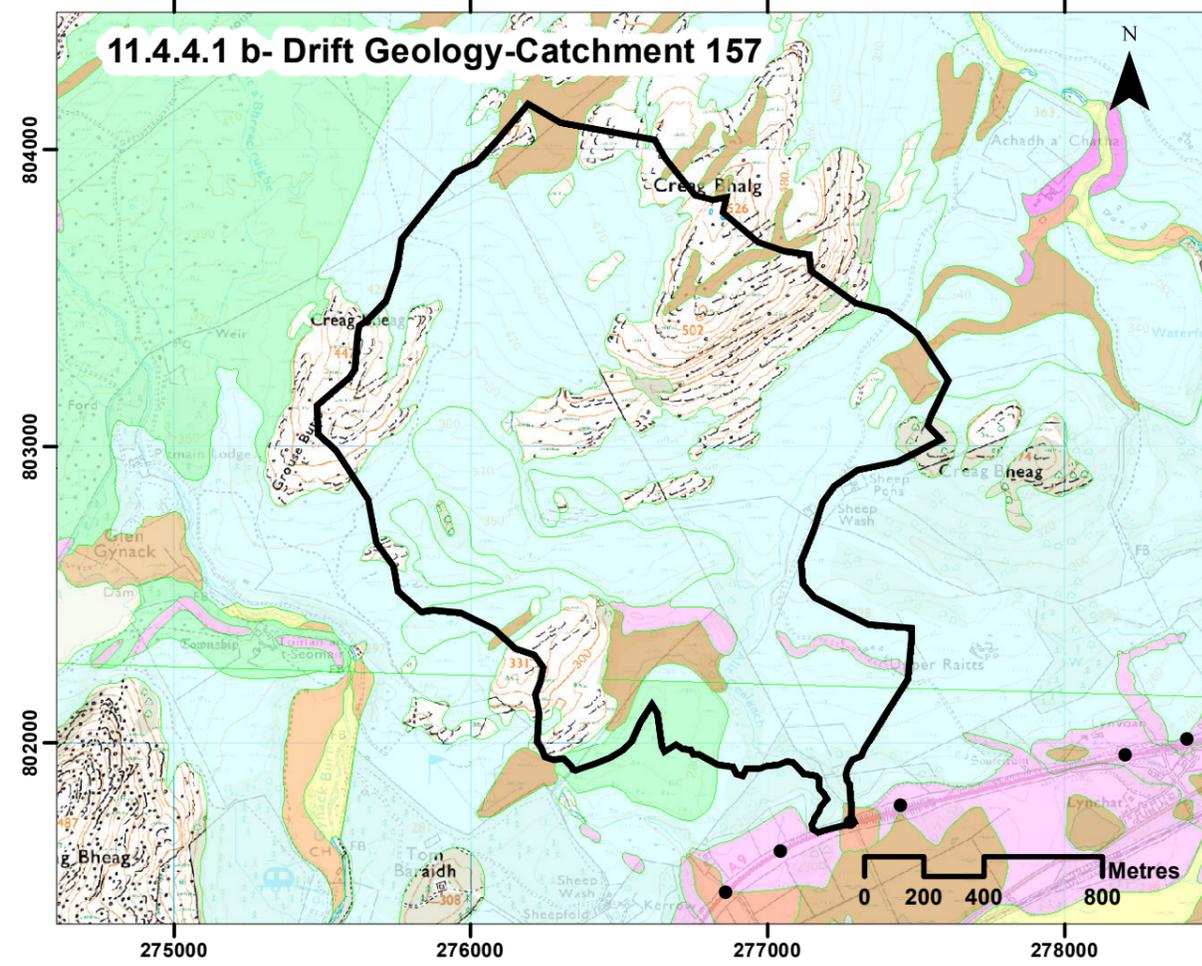
Annex 11.4.4-Hydromorphological Catchment Assessment-157

Catchment No.		157	
Catchment Name		Allt Craigach	
Channel Nature	Nature of water course	Natural	
	Size of water course	Major	
Quantitative Spatial Elements	Catchment Area (km ²)	3	
	Average slope in catchment (°)	8	
	% Catchment over 750m (for snow melt risk)	0	
WFD classification	Water, flows and levels	Good	
	Physical condition	Good	
	Overall ecological status	Good	
Geology	Majority Bedrock (see Drawing 11.4.4.1 a and b Catchment 157) Is an alluvial fan present at or near the crossing?	Loch Laggan Psammite formation- Psammite, Micaceous Yes	resistant to weathering, impermeable Risk of avulsion
Environmental designations (see Drawing 11.4.4.1 c, Catchment 157)	Ramsar	Yes	River Spey - Insh Marshes Breeding birds, wetlands, freshwater habitats, trophic range river/stream, Whooper Swan
	SAC	Yes	Insh Marshes Alder woodland on floodplains, clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels; Otter, very wet mires often identified by an unstable quaking surface
	SPA	Yes	River Spey Atlantic salmon, freshwater pearl mussel, otter, sea lamprey
	SSSI	Yes	River Spey - Insh Marshes Hen Harrier, Osprey breeding, Spotted Crane breeding, Whooper swan, Wigeon breeding, Wood Sandpiper
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.4.2, Catchment 157	
	Is peat present in the catchment?	Yes	Several reasonably extensive valley mire deposits. Blanket bog/watershed mire present in upper part of catchment previously delineated as Catchment 155.
	Is there a bog burst risk?	Yes	These are all relatively major peat deposits with bog burst potential until confirmed otherwise.
	Current valley side or terrace erosion	No	Little erosion of valley sides or bluffs in wider catchment, as the terraces seem to be palaeofeatures, relict from when more major watercourses (i.e. Gynack or Spey scale flowed through here)
	Potential valley side or terrace erosion	Yes	But limited, watercourses mostly some distance from slopes and undersized. Accumulation of peat indicates little active reworking of alluvial deposits in upper catchment.
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	On steeper descent to main channel - evident from geomorph photos
	Bank erosion/lateral migration	Yes	On steeper descent to main channel - evident from geomorph photos
	Unvegetated bars	No	Only immediately u/s and d/s of crossing, not wider catchment.
Wooded/forested areas in catchment	Yes	On steeper descent to main channel - evident from geomorph photos	
Infrastructure type (see Drawing 11.4.4.1 d, Catchment 157)	Yes	Access track in upper catchment but no apparent influence on channel network or sediment.	
Comment on sediment source potential in catchment		Google Earth shows no obvious actively producing sediment sources. Peat deposits have potential to produce large amounts of organic material if they fail, but source large sediment deposited at crossing, not obvious in wider catchment, so assumed generated in steeper gorge section in lower catchment.	
Comment on sediment supply potential to crossing		Numerous opportunities for deposition in upper catchment so only extreme events likely to transport sediment all the way from upper catchment. However, large volumes of coarse sediment have been deposited in the lower catchment likely sourced from limited distance u/s/	
Morphology and Process - Reach upstream of crossing	Channel morphology	Step-pool	But not exclusively - plane bed and some bedrock top
	Predominant sediment size	Coarse (Gravel-cobble-boulder)	
	Unvegetated bars	Yes	Major deposit of coarse material on left bank immediately u/s of crossing, although some of this may have been dredged to clear culvert.
	Vertical incision	Medium	Some evidence of incision to bedrock
	Deposition	High	Very high deposition of coarse material u/s of crossing
	Lateral migration/bank erosion	Medium	Erosion of banks evident
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 157)	No	
Morphology and Process - At crossing	Impact of infrastructure	No	
	Channel realignment	No	
	Channel morphology	Engineered	Pipe culvert
	Predominant sediment size	Cobble	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	High	
Lateral migration/bank erosion	Medium		
Damaged/unstable drains or armouring	Yes	Scour of fill on right of culvert entrance leaving structure exposed	
Morphology and Process - Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Coarse (Gravel, Cobble, Boulder)	
	Unvegetated bars	Yes	Possible Scour pool D/5 of culvert
	Vertical incision	High	Large volumes of coarse material deposited d/s of culvert
	Deposition	High	
	Lateral migration/bank erosion	High	Coarse deposits blocked initial channel and overbank, forming new flow route.
	Presence and nature of infrastructure (see Drawing 11.4.4.1 d, Catchment 157)	Yes	Railway
Impact of infrastructure	Yes	Limited locations through which flow can cross embankment	
Channel realignment	Yes	Channel has been straightened to take it directly to railway crossing	
Summary behaviour	Limited activity in this catchment. Limited realignment u/s of crossing. Seems stable and vegetated. D/s of crossing realigned, probably during railway construction to take flow from this and other channels through just one point along the railway embankment.		

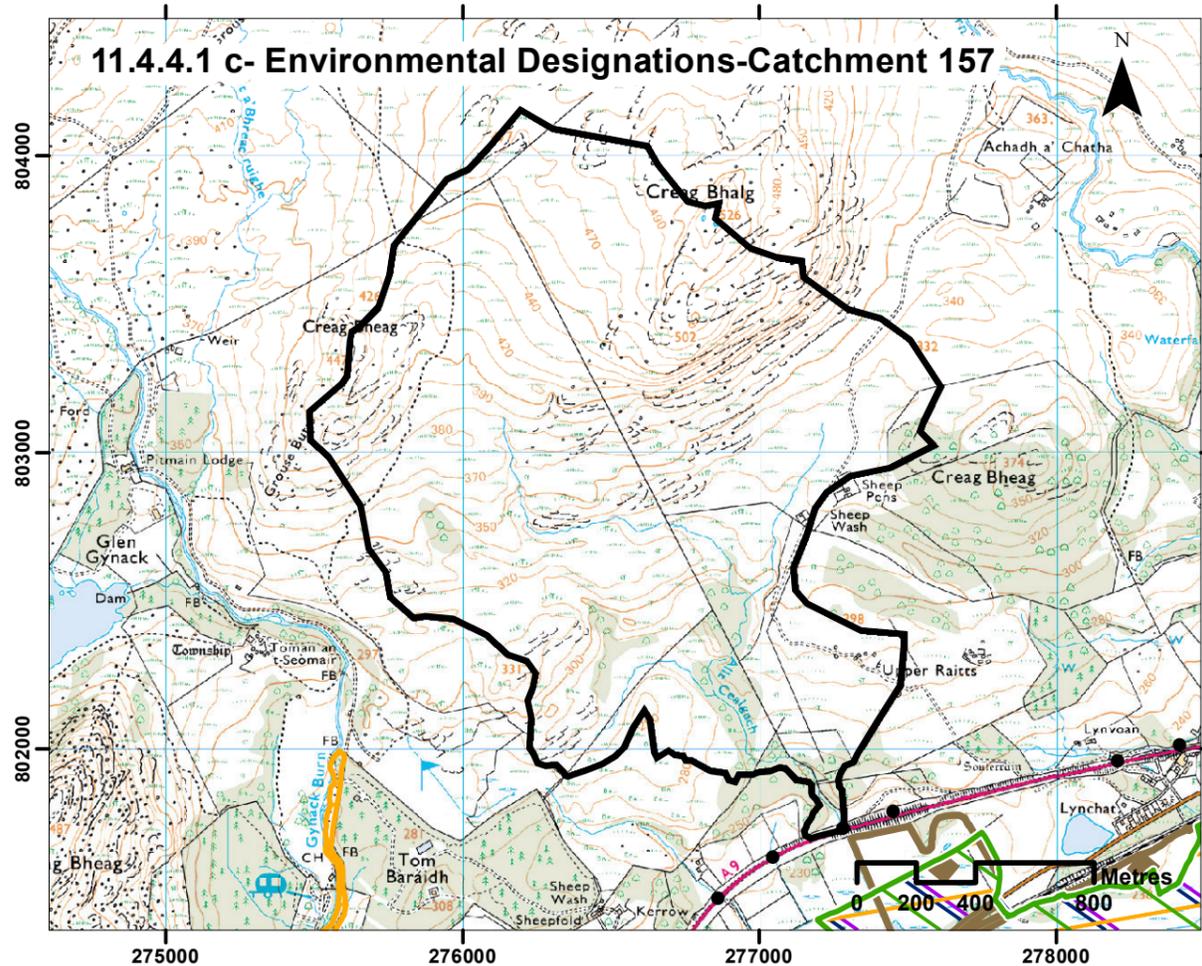
11.4.4.1 a- Solid Geology-Catchment 157



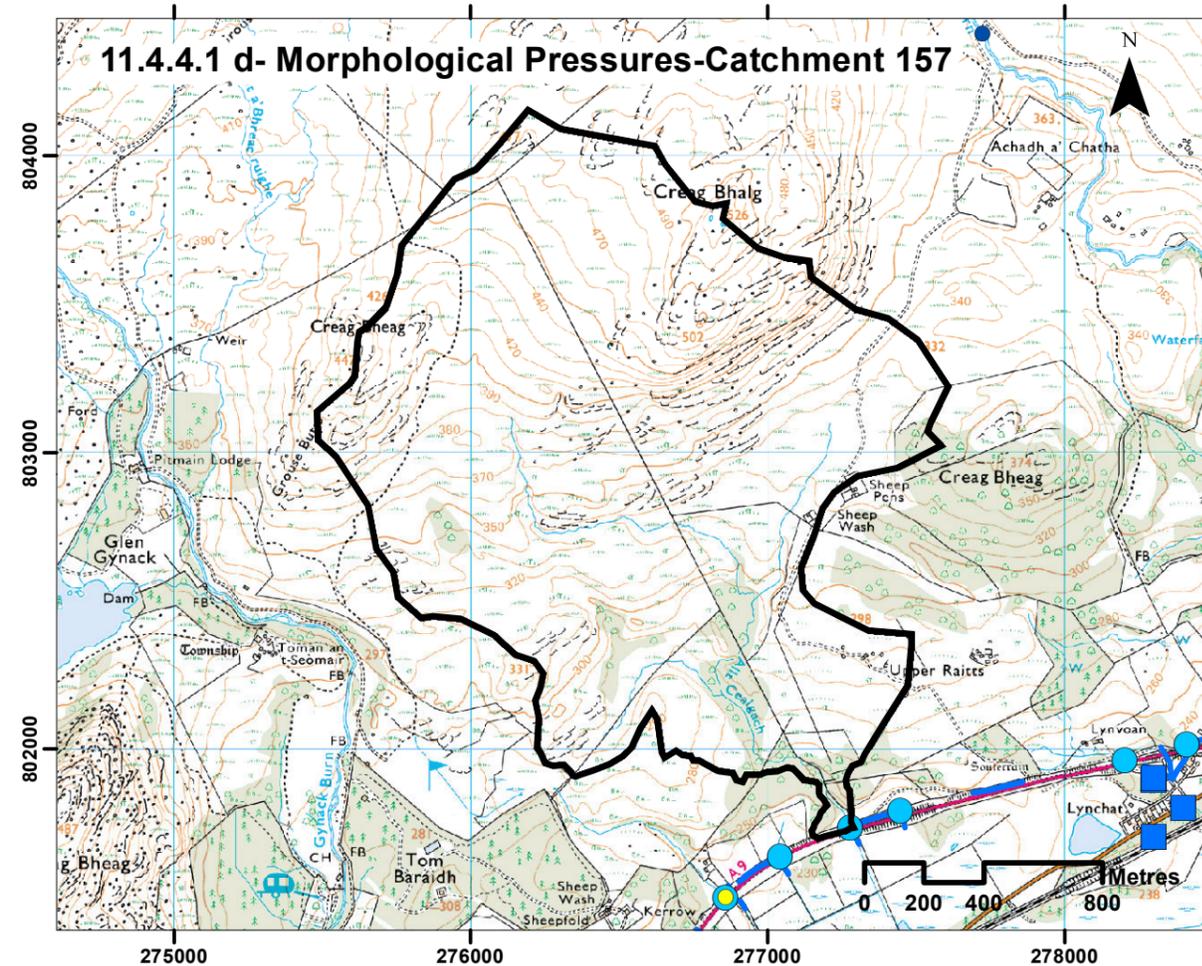
11.4.4.1 b- Drift Geology-Catchment 157



11.4.4.1 c- Environmental Designations-Catchment 157



11.4.4.1 d- Morphological Pressures-Catchment 157



Legend

General

- Crossing location

Solid Geology

- Gaick Psammite Formation - Psammite
- Loch Laggan Psammite Formation - Psammite, Micaceous
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite
- Pitmain Semipelite Member - Semipelite And Calcsilicate-Rock
- Pitmain Semipelite Member - Semipelite, Gneissose
- Scottish Highland Ordovician Minor Intrusion Suite - Leucogranite
- Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite- (Other Than Dykes) - Microdiorite

Drift Geology

- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverkie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

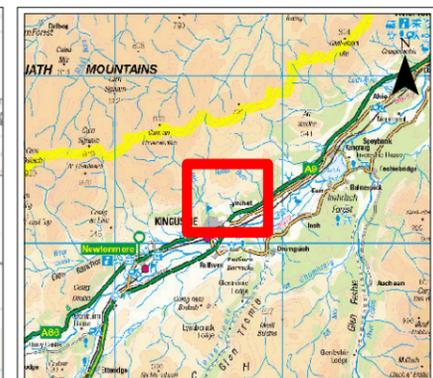
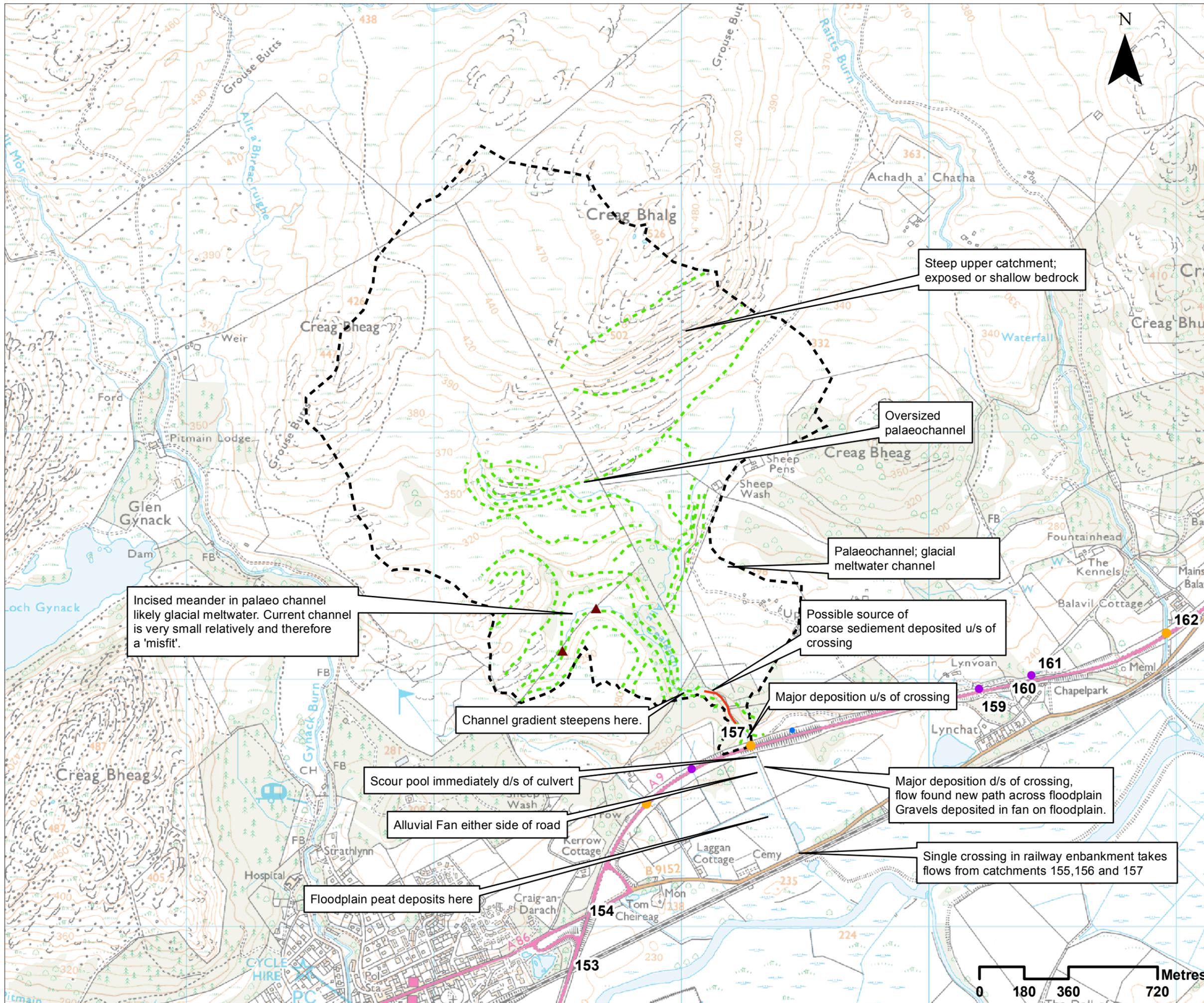
Environmental Designations

- Ramsar
- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area
- National Nature Reserve

Morphological Pressures

- Culvert
- Catchpit
- Ford
- Discharge Location
- Drainage Ditch

REV	SUIT	DATE	DESCRIPTION	BY	APP
<p>ch2m FAIRHURST CH2MHILL Fairhurst JV C/O City Park 368 Alexandra Parade Glasgow G31 3AU Tel +44 (0) 141 552 2000 Fax +44 (0) 141 552 2525</p>					
<p>A9 TRANSPORT SCOTLAND DUALING PERTH TO INVERNESS CRUBENMORE TO KINRAIG</p>					
<p>9 CRUBENMORE TO KINRAIG EIA</p>					
<p>Drawing 11.4.4.1 Catchment 157 Catchment Overview</p>					
DESIGN: EL	DRAWN: EV	CHK: EL	APP: EL		
DATE: 20/12/2017					
PROJ: 495298					
DWG: A9P09-CFJ-EWE-Z_72727_ZZ-DR-EN-0009					
SHEET: 1 of 1	REVISION: C01	SUITABILITY: A3			



Legend

- Major crossing
- Minor crossing
- Other crossing
- ▲ Peat
- - - Break in slope
- Incision
- Crossing catchment

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PROJECT 9 CRUBENMORE TO KINRAIG EIA
DRAWING 11.4.4.2.
Catchment 157 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	AB	EL	EL

DATE: 19/12/2017	PROJ: 495298
DWG: A9P09-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0010	
SHEET: 1 OF 1	SUITABILITY: A3



Culvert entrance

Photograph 11.4.4.37



Large scale deposition of boulders to fines

Photograph 11.4.4.38



Culvert entrance

Large scale deposition of boulders to fines

Photograph 11.4.4.39



Channel scoured to bedrock

Photograph 11.4.4.40



Erosion of left bank

Incision to bed rock

Photograph 11.4.4.41



Wooded valley

Step-pool morphology

Photograph 11.4.4.42



Boulder step

Pool

Photograph 11.4.4.43



Large scale deposition downstream of culvert

Change in flow path due to deposition

Photograph 11.4.4.44



Culvert exit cleared of sediment

Photograph 11.4.4.45



Large pool just downstream of culvert

Photograph 11.4.4.46



Flood debris caught on fence

Photograph 11.4.4.47



New flow paths

Photograph 11.4.4.48



Photograph 11.4.4.49

Gravels on floodplain starting to vegetate



Photograph 11.4.4.50

Channel as mapped currently dry



Photograph 11.4.4.51

Gravels on floodplain starting to vegetate



Photograph 11.4.4.52



Photograph 11.4.4.53